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SPINAL ANESTHESIA.

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There are two convenient methods of anesthesia, rectal anesthesia (N. R.), with oil-ether mitxure, and spinal anesthesia (R. A.). Their indications are not identical. One cannot operate upon the abdomen under rectal anesthesia, which distends the intestines, but spinal anesthesia contracts them and facilitates laporotomy. Spinal anesthesia is employed in three ways, (a) general, (b) high (abdomen, pelvis, upper extremity) (c) low (perineum, lower extremity).

For general spinal anesthesia, the method of Jonesco may be used, but I prefer that of Le Filliâtre, who injects 5 cgm. of cocaine, through the lumbo-sacral space, and recommends diffusion and withdrawal of 20 to 30 cc. of cerebro-spinal fluid. This method was of great service during the war, because it permitted operations on multiple wounds with a single injection. Thus, on the same patient, I performed a craniatomy and a resection of the elbow, and applied an apparatus to the leg. The analgesia lasts 60 to 90 minutes.

For anesthesia of the head and neck, and for the majority of my operations, the predominant *procedure was local and regional anesthesia* (1) For high and low spinal anesthesia, I use Corbières ampoules which contain two parts of procaine (novocaine) and one part of cocaine.

Indications. Spinal anesthesia is indicated in major operations on the abdomen, pelvis, and lower etxremities (amputation, disarticulation, resection of the knee, of the hip, of the thigh, high extirpation of the rectum, hysterectomy for cancer, gastrectomy for adherent ulcer, intestinal obstruction, etc.). In the last condition, (intestinal obstruction), spinal anesthesia improves the prognosis, because it causes intestinal contraction, relaxes the abdominal wall, and does not endanger the life of the patient from fecal vomiting, a result of narcosis.

As spinal anesthesia is less benign than local or regional anesthesia, I do not believe it should be employed for simpler operations in which local anesthesia suffices (hemorrhoids, varicocele, perineorhaphy, amputation of the foot, osteotomy of the femur, prostatectomy, craniotomy, goiter, cancer of the tongue, etc.).

Equipment: A 3 cc. syringe; 2 or three lumbar puncture needles with stilletes, and a short bevelled point; a glass graduate; tincture of iodine; ampoules of cardiac stimulants (oil of camphor, sparteine, or strychnine); ampoules containing the anesthetic powder to be dissolved in cerebro-spinal fluid.

Precautions. Plug the ears, bandage the eyes, maintain silence—useful preliminaries, but not essential. Inject subcutaneously, one hour before operation an ampoule of scopo-morphine and one of a cardiac stimulant.

Asepsis. Asepsis should be as perfect for spinal anesthesia as for a bone plastic. The fingers of the operator and the back of the patient should be iodinized. Sterile instruments and trays should be used.

Position of the Patient. The patient should be lying or seated; in the latter case the back is arched. For high abdominal operations (stomach, liver, kidney) the head and pelvis should be elevated, so that the middle of the back is in a lower position. In the case of an infant, it should be placed in such a position that the head and knees touch, bent like the arc of a circle, whilst the back remains in contact with the table. This position should be maintained for three or four minutes.

Puncture. Choose an inter-verterbral space, in the midline, dorso-lumbar, lumbo-sacral or between two lumbar vertebrae. For anesthesia of the upper abdomen, we advise dorso-lumbar puncture. For anesthesia of the perineum and lower extremities, lumbo-sacral puncture. The latter space is large, accessible in the median line, equidistant from the crests of the ileum, and the posterior inferior iliac spines. (Le Filliâtre).

Insert the needle in the midline slowly; at a given moment, a resistance is felt which gives way, the needle passes through the "dura mater" and penetrates the subarachnoid space. The fluid begins to flow. How much fluid should be withdrawn? If the tension is low, 10 cc., if it is high, withdraw 25 to 30 cc. into a graduate (Le Filliâtre). The

[1]Pauchet and Sourdat: "Anesthésie Régionale." Chez Doin, publisher, 1918.

first few drops should be permitted to flow into the ampoule containing the anesthetic powder; the powder is mixed and dissolved; if necessary it may be heated slightly to complete its solution.

How much anesthetic should be injected? For anesthesia of the stomach and liver, use an entire Corbière ampoule. It contains 6 cgm. of procaine and 3 cgm. of cocaine. The anesthesia ascends to the neck, and lasts an hour and a quarter. The dose should be judged in proportion to the severity of the operation. It should be weaker for the stomach than for the kidney, weaker for the uterus than for the stomach, and still weaker for the thigh, foot, or perineum. In the latter case, with lumbo-sacral puncture 1/3 of an ampoule is sufficient.

Fig. 1—Dorso-Lumbar Spinal Anesthesia. Injection of the "button" of skin. In order to avoid the pain due to spinal punctures, the operator infiltrates the skin with ½% procain and the tissues which form the tract of the puncture, up to the vertebral column. In this way, it is possible to use a large needle, without causing pain.

Technique of Injection. Fill the syringe with 3 cc. of the prepared solution (anesthesic powder dissolved in cerebro-spinal fluid). Inject the liquid slowly. Aspirate the cerebro-spinal fluid, reinject and withdraw two or three times so as to complete the diffusion in the spinal canal. Make the patient cough in order to encourage the diffusion of the fluid. The injection should occupy several minutes.

Errors. (a) There is no flow of cerebro-spinal fluid, because the needle has penetrated a nerve, or the epi-dural space, or a fatty mass. Insert the stillete, withdraw the needle about 1 mm. or push it in further. If in spite of these maneuvers the fluid does not flow, begin again in the space above or below, but not in the same one.

For the second puncture, use another needle.

(b) There is a flow of blood. Replace the stillete, push the needle forward or backward. If blood still flows, take another needle and puncture in the space above or below.

(c) The fluid flows too slowly. The opening of the needle is engaged in the dura mater. If one injects now, the solution remains in the epi-dural space and the patient is poorly anesthetized. Puncture in the space above or below with another needle.

(d) The anesthesia is nil or incomplete. The injection has been made into a vein, or into the epi-dural space, or the solution of the powder in the cerbro-spinal fluid has not been completed.

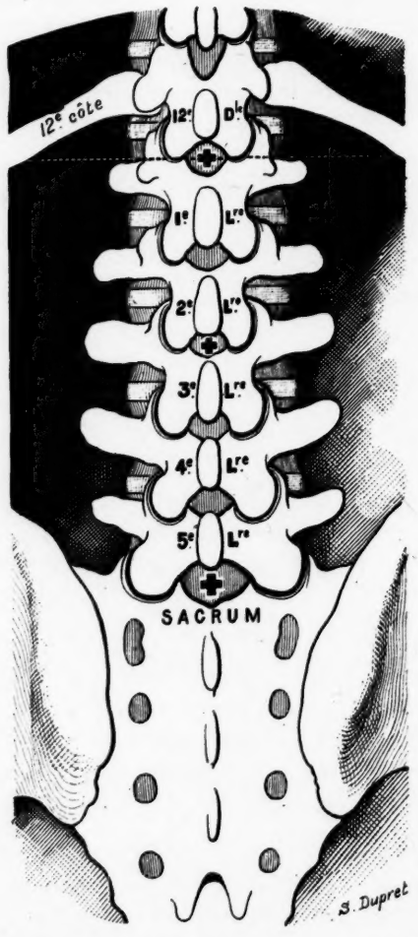

Fig. 2—The three points (black crosses) where lumbar puncture should be performed.
(1) dorso-lumbar puncture, outlined by a transverse line uniting the lower borders of the twelfth rib.
(2) median lumbar puncture, between the second and third lumbar vertebrae.
(3) lumbo-sacral puncture (Le Filiâtre); this presents the largest space.
These three punctures are made in the median line.

Accidents. (a) Retention of Urine. This may last several days.

(b) Vomiting. This is rare after the operation. Should it occur during the operation, apply cold compresses to the neck. (Walther).

(c) Sciatic Neuralgia. This occurs when puncture is made outside of the median line. It never lasts.

(d) Headache. A frequent occurrence. Give antipyrin. If violent, perform a lumbar puncture. Violent headache is rare with good technique.

(e) Anal incontinence, during the operation. The patient has involuntary defecation. This is troublesome in total abdominal hysterectomy as the feces may get into the vagina. The nurse should be instructed not to give an enema on the morning of the operation, to tampon the vagina, to purge the patient two nights before the operation, instead of the evening before, to give fluid diet from the time of purgation up to the operation.

(f) Asphyxia, from bulbar inhibition. The anesthesia may ascend sufficiently high to paralyze the respiratory center. If the patient is conscious, tell him to blow, or make him talk without stopping. As soon as the puncture is finished, instruct an assistant to tell the patient to breathe deeply for five minutes through the nose.

We have seen three cases of bulbar inhibition, it was necessary to employ artificial respiration, for ten to fifteen minutes. Paraplegia and ocular palsy are rare and only transitory.

I do not think this accident is possible, if the puncture is made according with the aforementioned precautions.

(g) Death. Deaths are rare, but may occur as with chloroform. Spinal anesthesia, is neither more nor less dangerous than chloroform anesthesia. Patients suffering from shock, or enfeebled by infection, tolerate spinal anesthesia badly.

I consider spinal anesthesia as a convenient method, which improves the prognosis in a large number of operations, but which entails as many risks as narcosis. The sugeons who encounter no complications are those who apply it with a ritual regard for detail, and who do not attempt to use it in shocked or enfeebled patients.

In conclusion, spinal anesthesia, presents some immediate dangers, almost negligible. But, it has no untoward action on the lung, liver, or kidneys. It allows severe traumatizing operations to be performed with minomal shock, such as resection of the hip or amputation of the thigh, in wounded soldiers. It lessens the danger of major abdominal operations, because it contracts the intestines, relaxes and quiets the abdominal wall. Hysterectomy for uterine cancer, laparatomy for acute intestinal obstruction, are performed with greater ease, and with less danger, under spinal anesthesia, than under general narcosis.

This method has gained ground during the last few years, and will gain more every day.

SOME APPLICATIONS OF SPINAL ANESTHESIA.

Abdominal Hysterectomy. We shall refer only to abdominal hysterectomy, because vaginal hysterectomy even when associated with a vagino-perineal incision which gives very wide exposure, may be performed under trans-sacral anesthesia.

For abdominal hysterectomy (for fibroids, salpingitis, and especially for uterine cancer), spinal anesthesia is certainly the best. It can be employed as follows: according to the method of Le Filliâtre, (5 cgm. of cocaine by the lumbo-sacral route, in the large space which separates the fifth lumbar and first sacral); or a mixture of procaine and cocaine (1/4 of cocaine and 3/4 of procaine), injected between the third and fourth lumbar vertebrae, or between the twelfth dorsal and first lumbar.

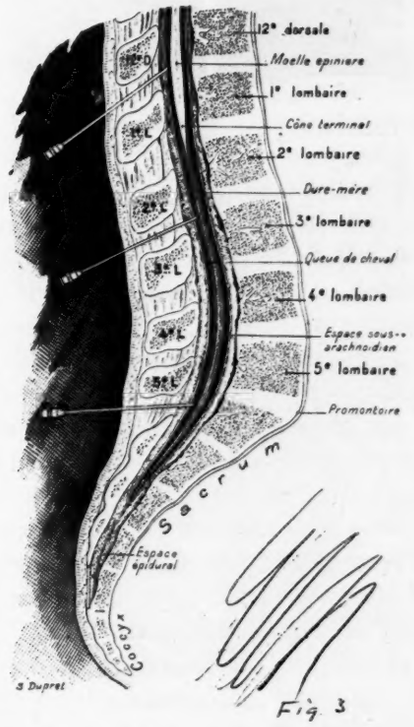

Fig. 3—The three points for lumbar puncture.
(1) Dorso-lumbar, the needle is held slightly obliquely upwards in order to enter the spinal canal; stop as soon as the fluid runs, so as not to penetrate the cord. This, however, is not dangerous as long as no fluid is injected into the cord. Such injection might dissociate the nervous structures. High injection is useful for operations on the stomach and thorax. Make the patient cough, aspirate and inject several times in order to insure good mixture of the cerbro-spinal fluid and the procaine. In this manner very high anesthesia may be obtained, particularly if care is taken to withdraw 15-20 cc. of fluid, in advance.
(2) Median-lumbar. At this level, there is no more cord, but only the cauda equina.
(3) Lumbo-Sacral. Here there are only nerves. At the midline there will not be a single nervous filament. This is the safest place to inject, if the puncture is made exactly in the midline.

In dorso-lumbar injection, care must be taken not to push the needle too far, so as not to pierce the cord; the accident will cause no great inconvenience as long as the operator does not inject the solution, until the cerbro-spinal fluid flows; fluid will not flow as long as the needle is in the cord

In order that the spinal anesthesia be effective,

a complete diffusion of the anesthetic product is necessary. This is obtained by asperating the fluid and reinjecting it at definite intervals. The contact between the spinal roots and the anesthetic mixture takes place in the sub-arachnoid space.

For a uterine fibroma, an operation lasting usually from 20 to 45 minutes, a simple spinal anesthesia is sufficient, using the whole of one of Corbière's ampoules (6 cgm. of novocaine, and 3 cgm. of cocaine). The anesthesia is perfect and lasts at least one hour. If the surgeon wishes to inject a smaller quantity, he can infiltrate the abdominal wall as for uterine cancer.

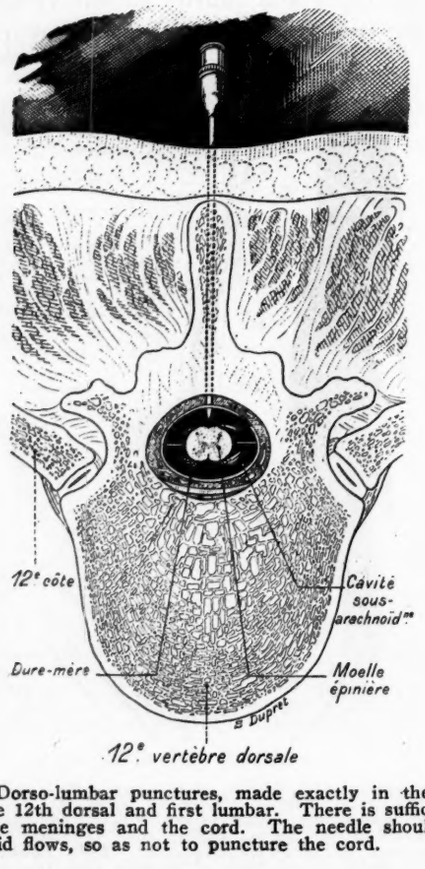

Fig. 4—Dorso-lumbar punctures, made exactly in the mid-line, between the 12th dorsal and first lumbar. There is sufficient space between the meninges and the cord. The needle should stop as soon as fluid flows, so as not to puncture the cord.

For Cancer. Hysterectomy for uterine cancer requires a good deal more time than for fibroma (50-80 minutes). For this purpose, simple spinal anesthesia may not be sufficient; local anesthesia of the abdominal wall may be used along a line from the umbilicus to the pubis. For this purpose use hydrochloride of quinine and urea, which has the advantage of giving a prolonged anesthesia (several days), so that the patient during recovery from the anesthesia, experiences no pain. These post-operative pains are often excited by vomiting, coughing, or movements. A 1% solution is used. The sheath of the rectus is first infiltrated over an area the width of the thumb. The subcutaneous cellular tissue is also infiltrated.

The patient should be warned that, the cicatrix of the skin may be indurated for several weeks or months; this is the effect of the quinine, but it is not permanent. The patient should be instructed to mobilize the indurated skin with her fingers, in order to soften it. The injection of uro-quinine is agreeable to the patient, for it prevents post-operative suffering for several days. Its use is also recommended in certain very painful operations like tonsillectomy, and operations on the anus (hemorrhoids, fistulae). It will prevent suffering.

Surgeons who prefer general anesthesia to spinal

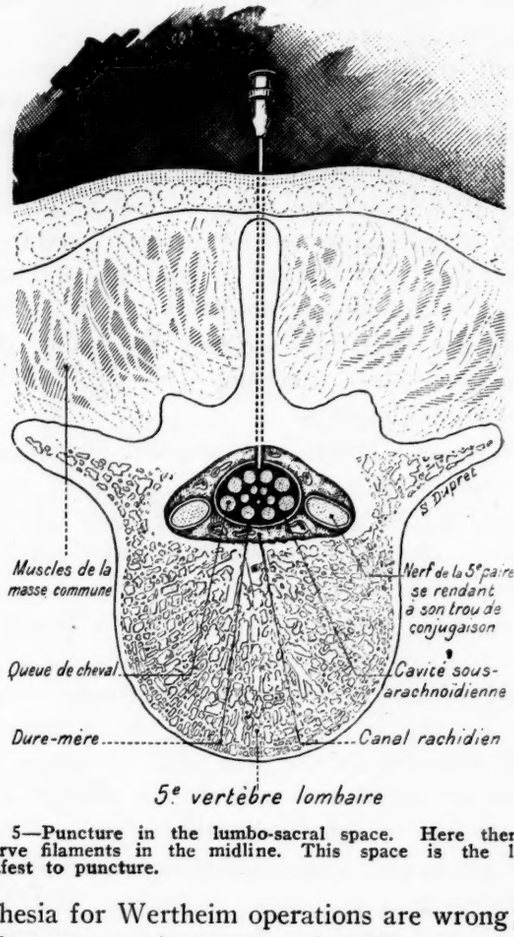

Fig. 5—Puncture in the lumbo-sacral space. Here there are no nerve filaments in the midline. This space is the largest and safest to puncture.

anesthesia for Wertheim operations are wrong; for the dangers are the same as in either case, while the operation under the latter is easier, and can be performed better because of the abdominal "quiet," the relaxation of the abdominal wall, and the fact that the patient does not push out her intestines. The operation can be performed better, and the patient recovers more rapidly.

I can comprehend why surgeons may use ether or spinal anesthesia, indifferently, for uterine fibroids, but for uterine cancer the advantage belongs to spinal anesthesia, which has a lower mortality, because the operation can be performed with greater ease and perfection.

Intestinal Obstruction. In a patient suffering

from acute intestinal obstruction, for several days, the abdomen is distended and tense; do not perform a laparotomy. The loops of intestine are distended and manipulation would be dangerous; the pressure of the fingers and packings might tear the intestine denuded of its serosa and favor the onset of peritonitis. There is, however, one exception, valvulus of the sigmoid; here the entire involved intestine should be delivered, an artificial anus will not suffice. The sigmoid is untwisted, marsupialized, fixed to the abdominal wall, and the loop cut immediately or two or three days later. At a second operation the artificial anus is closed.

In cases where artificial anus is not indicated, as for example in an abdomen which is not distended, and in which the obstruction is recent, in which the diagnosis is made by the colic and visible peristalsis, followed by borborygma, perform a median laparotomy to relieve the obstruction. This operation may be done under spinal anesthesia. Spinal anesthesia has the following advantages in these cases.

1. The patient suffers less from intoxication, the anesthetic being rapidly eliminated. The kidneys are not affected, neither is the liver.

2. Spinal anesthesia induces intestinal contractions, and the intestines are small instead of being distended.

3. The abdominal wall is soft, relaxed, and exploration is thereby rendered very simple.

4. Fecal vomiting is avoided during the operation, a complication which may lead to immediate or later death from aspiration pneumonia. This accident is avoided, particularly if the stomach is washed before operation (an indispensable precaution).

Abdominal Operation for Carcinoma of the Rectum. When the cancer is situated low, at the level of the ampulla of the anus, in other words when it is necessary to sacrifice the anus, the operation is performed by the sacral or perineal route. For this, trans-sacral anesthesia is sufficient. However, when the cancer is situated above the ampulla of the rectum, particularly if it reaches the sigmoid, a laborotomy is necessary. The entire descending colon must be mobilized, with incision of the fascia, the inferior mesenteric artery is freed, a band of mesentery 3 cm. in with is left along the length of the descending colon, and a long loop of intestine extirpated, up to a point where the gut seems free from cancer, healthy and well nourished. For this operation a relaxed and quiet abdomen is essential. It is performed best under spinal anesthesia. The pulmonary complications of ether, and the hepatic and renal complications from chloroform need not then be feared. The patient recovers quickly. For cancer of the intestine, as for cancer of the rectum it is advisable to infiltrate the abdominal wall with quinine and urea hydrochloride which insures a prolonged anesthesia.

THE USE OF PROPYL ALCOHOL AND SOLUTIONS OF CERTAIN DYESTUFFS IN PROPYL ALCOHOL IN SURGICAL THERAPEUTICS.

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The hydrating action of alcohol in general has long been known. Thus wood alcohol (methyl alcohol) combines with two molecules of water; grain (ethyl) alcohol with four; propyl alcohol with eight; butyl alcohol with sixteen; amyl alcohol with thirty-two, etc. Up to date only ethyl alcohol has been used in surgical technique and principally as a disinfectant of the hands (Ahlfeld). Its albumin-precipitating properties are well known and Beyer thinks that its therapeutic action depends upon its poisonous properties but that its poisonous property is counteracted by the hygroscopic property of the alcohol. The precipitation by alcohols of albuminous materials depends upon the presence of salt, (Fischer) and when alcohol acts upon bacteria (in a watery medim) it causes a precipitation in the bacterium and thus kills it.

Tests have proved that 16% propyl alcohol kills bacteria quicker than 24% ethyl alcohol or 32% methyl alcohol, but there is another factor that determines the killing action and that is the surface tension of the alcohol in question. Traube and Czapek have shown, that in undiluted conditions, the surface tension is very low and if it is added to water, the surface tension of this is much reduced. All questions of osmosis and narcosis depend on this surface tension. The surface tension is calculated by means of the usual stalagmometer. (Either the Traube or the Amann stalagmometer can be used). If the tension of propyl alcohol in water (1 in 3) is equal to 0.4, then the stalagmometer with this mixture yields 240 drops of a 25% propyl alcohol at 15° C. etc., etc.

Czapek has proved that for a number of substances the surface tension must be 0.68 in order to enter into the interior of the living cell and kill it. This question of surface tension is of the utmost importance as it explains hemolysis according to the investigations of Fuhner and Traube.

The surface tension of the erythrocytes is about 0.6; of the yeast cells about 0.5 and Christiansen calculates that of bacteria to be about 0.4 and that of spores to be about 0.3. The surface tension should be carefully studied where intravenous injections are practiced.

The low number, 0.3, explains why alcohol does not kill spores even by long contact. Extensive studies of the surface tension have been made by Ducleaux, Traube, Kirch, Ramsay, and Christiansen.

Wirgin draws the conclusion that propyl alcohol is the deepest acting and that no kind of alcohol exercises disinfecting activity on a dry obpect in undiluted condition. Christiansen has shown that at 25° C., the time consumed for disinfection is one-half minute with a surface tension of 0.45 for methyl alcohol; with 0.43 for ethyl alcohol (acetone has 0.42).

Of all the alcohols only propyl alcohol disinfects at as low temperatures as 0° in a dilution of from 30% to 100%. As said before, alcohol kills bacteria only in moist condition. At the proper surface tension on entering into the bacterium and aided by the salt in the protoplasm, this is precipitated; but the alcohol also draws on the water from the protoplasm, which fact may save the life of the bacterium. That propyl alcohol kills even at 0° indicates that the water absorbing action takes place so quickly that it overshadows the protective one. The precipitation of the protoplasm in the bacterium depends, as already mentioned, upon the amount of salt present, but Kruse has proved that spores are poor in salt and hence alcohol will not kill them as it will bacteria. Saul killed spores by boiling them with 30% propyl alcohol. As the surface tension of spores is very low (0.3) and that of the propyl alcohol (25%) is 0.4, the propyl alcohol is unable to reach the interior of the spores. The disinfecting property of the alcohols depends upon the surface tension. At the proper tension propyl alcohol disinfects four times better than ethyl alcohol and dissolves the fat on the skin. Propyl alcohol painted on the skin is quickly absorbed and is furthermore non-poisonous. It is, however, first in dilutions higher than 35% than it is hygroscopic (one molecule propyl alcohol mixes with eight molecules of water. The disinfecting concentrations of propyl alcohol is thus below 35. The higher alcohols, like butyl, amyl, etc., are but little soluble in water. The experiments demonstrate that propyl alcohol is admirably adapted for skin disinfection, as it has a low surface tension and can mix easy with water and lipoids; yet its surgical use up to date has been but little utilized. Saul sterilized surgical sponges by boiling them with 30% propyl alcohol.

Of other investigators over the use of alcohols for sterilizations must be mentioned Buchner, Fuchs and Wirgin. Concerning propyl alcohol, it must be remembered that it loses its disinfecting properties if mixed with more than four times its volume of water (different surface tension coefficient). The value of alcohols depends upon their ability to penetrate the layer of fat on the skin, and in which bacteria are found, and their ability at the same time to kill the bacteria, all of which, as already said, depends upon a low surface tension and great ability to combine with water and lipoids. Fifty per cent. propyl alcohol is thus a better cleanser of the skin than a 2% solution of silver nitrate.

Ethyl alcohol has been used extensively in surgery and its best action seems to come from a 70% solution but if diluted with the natural fluids in a wound it loses its penetrating properties and if used in higher concentration than 70% it is painful and precipitates the albuminous substances. (Phul, Wohl). Christiansen also examined the action of serum in relation to propyl alcohol; a 24-hour old bouillon culture of staphylococcus pyogenes aureus was mixed with three volumes of horse serum, and to one ccm. of this mixture (in two test tubes) were added equal parts of a 50% and 70% propyl alcohol.

In one minute and at 20° C. all the bacteria were killed; nitrate of silver gave the same result under identical experimentation, but one per cent. silver nitrate and ethyl alcohol in any concentration did not kill the bacteria as quickly. The best propyl alcohol appears to be that of Kahlbaum (n-propyl alcohol); in this country Eimer & Amend Co. of New York furnishes an equally good product.

The fat-removing property of the propyl-alcohol we have employed in hand-disinfection. The hands are scrubbed with ordinary sterilized bristle hand brushes, using warm water and green or Castile soap, using several brushes for one scrubbing. Now apply 50% propyl-alcohol to the subungual space, followed by 25% propyl-alcohol. Finally the whole hand is rubbed with 50% propyl-alcohol. This leaves the skin in a dry, but smooth condition. Following this method we have operated without using gloves upon a large number of patients, without any trace of infection whatever, using both silk and catgut for ligatures and sutures. Bevan, in his "General Surgery," mentions the test of Haegler, using

liquid Chinese dye to test thoroughness of the sterilization. Apparently the most delicate cutis can tolerate the us of the propyl-alcohol in the strength here employed and the author and his helpers have used it with always good results in even the dirtiest cases imaginable.

The best result in wound treatment has been obtained with 25% propyl alcohol.

The author having used the various dyestuffs in wound treatment for a number of years, thought of suspending the dyestuffs in 25% propyl alcohol and has used it many times in single solutions as for example 2% malachite green with or without the addition of an equal amount of mercuric chloride (1% or 2%) in 25% propyl alcohol. The malachite in propyl alcohol without the addition of the mercuric chloride seems to act equally well. Tildes had previously employed these chemicals dissolved in 80% ethyl alcohol. The mixture of the mercuric chloride and the malachite green forms a double compound of one molecule malachite and two molecules mercury; this forms a leucocompound which becomes invisible in the wound, but becomes invisible in the wound, but nevertheless acts and maintains its activity.

Besides malachite green, other members of the *diamidotriphenylmethane* group (brilliant green) were suspended in 25% propyl alcohol and employed (Ehrlich) in the treatment of infected wounds (Dakin, Browning). We have also tried the fuchsines in a similar manner as the crystal violet and methyl violet (Dryer); our observations have been that infected wounds treated with propyl alcohol or certain dye stuffs dissolved in propyl alcohol heal quicker than when the Carrell-Dakin (hypochlorite) or other methods had been employed. Especially in cutaneous infections excellent results were obtained with fuchsine suspended in propyl-alcohol. Propyl alcohol has been employed in dentistry to rapidly disinfect root canals; and it acts rapidly on account of its dehydrating properties.

In many cases of fistulas of long standing, the propyl alcohol aided decidedly in establishing a rapid cure, by first painting the track with 50% propyl alcohol, followed by a solution of malachite in 25% propyl alcohol; when dry fill up the fistula with Calot's mixture to which a small amount of malachite green had been added.

Several cases of purulent pleurisy were treated with puncture followed by injection through the trocar of an ounce or more of a solution of methyl violet in propyl alcohol, the process being repeated some days later, if conditions demanded it. On many occasions only one single puncture was needed and seldom more than three punctures.

Several cases of infection of the knee joint were treated by free evacuation of the fluid, washing the joint cavity with ether and finally injecting a small amount of suspension of methyl violet in 25% propyl alcohol and dressing the wound without drainage. One case of infection of the knee-joint following a penetrating bullet wound from a Mauser rifle was treated by simply removing the fluid with a small trocar and injecting methyl violet in propyl alcohol through the same trocar; no ether could be had at this moment; the wound was dressed without drainage and the patient recovered with a useful joint.

Another case of interest is that of a soldier with an infected wound after a bayonet thrust through the arm and fleshy part of the chest, which had resisted the hypochlorite method of disinfection for more than three months; the wound was treated with a suspension of malachite green in 25% propyl alcohol; on other days with plain 25% propyl alcohol, while the skin around the wound was painted with 50% propyl alcohol. In less than two weeks the suppuration was under control and the remaining fistula was filled with Calots mixture; the fistula closing under one dressing. The author has treated several hundred cases of infected wounds of greater or lesser severity. but which could not be enumerated in an article like this, where the results have been so strikingly good and the time saved in disinfecting wounds by this method is considerable, that he deems the method worthy of general use.

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MODERN METHODS EMPLOYED IN THE TREATMENT OF GAS BACILLUS INFECTION.*

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SAYRE, PENNSYLVANIA.

In a paper read before this society in 1912 I reported eight cases of gas bacillus infection—three occurring in the work of J. M. Wainwright, five occurring in my own work. In this paper it was pointed out that while gas bacillus infection was comparatively a rare disease, it might happen after any injury; but that the type of wound it was most likely to develop in was the crushed one in which there had been destruction of tissue and interference with the blood supply from injury to the vessels. Attention was also drawn to the extremely short incubation period between the injury and the appearance of the infection. The importance of early recognition and prompt treatment before the development of the toxemia was emphasized. The appearance of the wound having such infection, and the thin bloody discharge with the characteristic sweetish, pungent foul odor were described, and I urged that the surgeon dress and inspect these wounds himself so that the infection would be recognized and combated early should it develop.

Two plans of treatment were outlined in that paper—the preventive and the treatment of the infection itself. In the preventive treatment, I suggested that, after a thorough removal of all injured tissue, the wound be well washed out with an oxidizing solution — potassium permanganate — that the flaps be left open, and that the wound should be inspected by the operator at least twice a day; that, in case of amputation above the crush, the same treatment be carried out—the flaps should not be sutured until the danger period had past which we considered to be five to seven days. If there developed any sudden rise of temperature soon after the operation, or if the patient became restless and complained of pain out of proportion to the amount the operation should have caused, the likelihood of a beginning of gas bacillus infection was to be considered. Wounds having gas bacillus infection upon admission or developing it afterward were treated by the conservative method outlined by Cramp, which planned to reduce the high mortality that attended amputation, and to save limbs if possible. It consisted in multiple free incisions to relieve tension and allow the gas to escape, washing the wound well with permanganate solution, discarding all dressings and using a continuous drip of permanganate solution with supportive measures.

The discussion revealed that this infection was extremely rare in the work of the members of this Society and I was led to believe that the infection was endemic to certain soils—especially those richly fertilized. The correctness of this belief is well borne out by the prevalence of gas bacillus infection on certain war fronts, and its rarity or absence upon others. Army reports show that the infection was not common on the Russian front where mobile warfare in the lake and forest countries was fought; it was comparatively rare on the Italian front where mountain warfare was fought, but was exceedingly common in the trench warfare in France and Belgium, whose soil was rich from years of intensive fertilization.

The war has added much to our knowledge of the infection which the surgeon may use to advantage in his work, for our crushing wounds in railway surgery resemble very much those caused by high explosives and if we will follow the doctrines laid down by these heroic army surgeons our results in the future should be much better than they have been in the past.

While, as is known, the *bacillus aerogenes capsulatus* is an anaerobic bacillus, oxidizing solutions will not destroy it if there is devitalized dead tissue in the wound—neither will the strong antiseptics or the actual cautery advocated in the beginning of the war. It has been definitely proven that dead tissue is essential to the growth and welfare of the organism and because of this fact the modern methods of prevention and of combating the infection have been planned.

It was in the tearing, crushing types of injury by high explosives that gas bacillus infection commonly developed, and much less frequently in the clean cut wounds of machine and rifle bullets.

Early and thorough débridement—the removal of all injured tissue, skin, subcutaneous tissue, fascia, parts of muscle, muscles entirely, from the origin to the insertion, or groups of muscles, large sections of bone or bones, the inspection of the blood supply to the part to determine the amount of injury to the vessels—practiced by those skilled in its employment was essential in the treatment of these wounds, with primary or secondary suture depending upon the length of time which had elapsed between the receipt of the injury and the operation, and the individual skill of the operator. Wounds infected at the time of operation were best treated by delayed suture and in the interval, through gaping flaps, a continual drip of Dakin solution was employed. In

* Read at the twenty-ninth annual session of the New York and New England Association of Railway Surgeons, held at the Hotel McAlpin, New York City, October 20, 1919.

performing débridement an anatomical dissection should be made. It can best be done by sharp dissection, and all rough handling and blunt dissection should be avoided. It is not always necessary to remove large areas of skin and the subcutaneous tissue, but the muscles should be removed extensively if they show evidence of devitalization—this is indicated by hemorrhagic infiltration and the failure to contract or bleed when pinched or cut. Dean Lewis describes a muscle which is apt to be the seat of gas gangrene as having a waxy appearance, looking somewhat as if it had been boiled. These muscles should be widely removed but the tendons should as a rule not be divided. "It is surprising," says Lewis, "how little disability follows extensive débridement, if it is anatomically performed."

Wounds having gas bacillus infection were treated by wide excision, delayed closure and irrigation by Dakin solution, the real worth of which was found to be its dissolving action upon clots, its separation of sloughs and its mechanical cleansing rather than upon its antiseptic properties. The *x*-ray was used to detect collections of gas in the muscle sheaths and fascial planes far remote from the site of infection and proved its worth in finding such collections which had been overlooked at the time of operation. The question of amputation depended upon the condition of the patient, the extent of the infection, its proximity to the body and whether or not the infection could be controlled by conservative measures.

Van Beuren gives the following general rules for the treatment of gas bacillus infection:

(1) Operate as early as possible under nitrous oxide oxygen anesthesia, if you can.

(2) Prepare the part with the least amount of trauma and delay.

(3) Avoid tourniquets.

(4) Make incisions longitudinally and half again as long as you think they need be both in skin and fascia, but leave as much skin as you dare in your débridement.

(5) Go between rather than through normal muscles, but open the wound as thoroughly and as freely as you possibly can.

(6) Excise all torn, crushed, discolored, non-contractile muscle until you have left only that which is firm, or normal color, actively contractile and which bleeds readily.

(7) Make a careful search for and remove all loose bone and foreign bodies, especially clothing and blood clots.

(8) Stop all bleeding and leave the wound well open and separate its walls with wet gauze laid in, not packed in.

(9) Use Carrel tubes, plenty of dressings and make careful splint fixation.

(10) Do all this as rapidly as you can.

The sera prepared by Sacquepee, Weinberg and Bull, in the early part of the war did not prove to be effective, but there is yet hope that an antitoxin will be found that will combat the toxemia as effectively as the toxemia of tetanus is controlled by the antitetanic serum.

The lessons that those who practice surgery in civil life may learn are many. Gas bacillus infection instead of being a rare disease is now known to be quite common—the crushing injuries, with great loss of tissue and interference with the blood supply to the injured part, contaminated by soil and clothing are the types of wounds the infection is most likely to occur in, but we should remember it may be met in any wound. (It has been reported in post-operative wounds, after subcutaneous injections, obstetrical operations, animal bites, and goring of animals.) These wounds should be treated by removing all devitalized tissue and traumatized tissue which may die later. Muscles should be cut away until the color and the bleeding from the edges of the parts to be left should lead us to believe that that remaining part is viable. All splintered, shattered bone or bones should be removed and the blood supply to the part should be inspected. Delayed closure is the safest method to employ. Let us pin or sew back our flaps, use hypertonic salt solution or Dakin solution and wait at least a week before closure, or if we are treating an already badly infected wound let us wait at least eighteen days or longer before closure, being guided by bacterial counts and cultures for streptococcus and, what is equally important, by the condition of the patient.

The tourniquet if wrongly applied or left on for an indue length of time will traumatize the main vessels and interfere with the circulation to the injured part. May I urge you to instruct your first-aid teams and assistants again in the proper application of the tourniquet — to emphasize its dangers and to operate yourselves without its use if it can possibly be done.

Gas-oxygen anesthesia has proven itself to be safer than ether, but there are times when spinal anesthesia will be found to be safer than gas and oxygen in operating upon serious injuries of the lower extremities.

With the substitution of the ballast road bed for the dirt, the number of intelligent first aid teams

and well equipped hospitals along our railway systems, with the knowledge of the importance of early and thorough débridement with removal of all foreign bodies and with the use of Dakin's solution and delayed closure, gas bacillus infection should be a rare complication in our work in railway surgery; but let us remember it is likely to occur in the work of any of us. It is important that these cases should be watched and treated by the operating surgeon and not by his assistants in order that should gas bacillus infection occur it may be recognized early and combated intelligently.

A METHOD FOR THE TREATMENT OF BURNS WITH BLEB FORMATION.

EDWARD F. ZIEGELMAN, M.D.,
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and
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OUTLOOK, MONT.

The object in the treatment of extensive burns of the body is to overcome shock, limit the amount of pain, prevent toxemia, shorten the time of convalesence and prevent infection. The treatment of surgical conditions of this kind, regardless of whether the etiology has been physical, chemical or electrical, has always been most difficult from the standpoint of obtaining an early satisfactory result. It is true that with our most modern methods of treatment the mortality and morbidity have been lessened and the period of convalesence greatly shortened.

The surgeon has passed through a cycle of therapy in the treatment of lesions of this type, including the vegetable lotions used by our forefathers, and the application of various kinds of ointments and lubricating lotions, some impregnated with chemicals and others without. Unfortunately I believe a great many of the profession still persist in the use of remedial measures of this kind, a procedure that does not indicate progress. The most recent method and what has probably proven to be the most satisfactory is the use of the aqueos solution of chemicals, especially the use of a solution of sodium bicarbonate or the application of one of the many paraffin formulas in the form of the spray. The use of these most recent methods has been a great step forward in bringing about an early and satisfactory result in the treatment of burns.

In a burn of any degree in which the structures are not completely destroyed the reaction is manifested by an exudation beneath the epidermis with the formation of bullae or blebs. The chemistry of this serum is probably different from that of the blood plasma and from that of bullae or blebs present in inflamatory conditions other than burns. It is true that the serum is one of the manifestations in the composite picture present in any inflamatory condition, the quantity depending solely upon the severity and extent of the burn. Whatever the change in the chemistry of the serum from these blebs may be whether due to a change in the inorganic salts or the addition of higher compounds brought about by the destruction of the proteid elements of the cells, it suffices to say that the absorption of this material is a very important factor in the toxemia that accompanies burns of severe degree. The great pain and the consequent consumption of a large amount of nerve force is probably very important in the formation of shock.

Any method which has a tendency to prevent or overcome the dangerous elements of shock, toxemia or infection must meet with the approval of the profession. The procedure we are advocating and about to describe has proven in our experience to warrant this belief and certainly is worthy of trial. The technique was first used by one of us (Mangan) in France and it has proven so satisfactory that one of us (Ziegelman) has utilized it in a few cases in civil practice and with most excellent results. At first we felt that its virtue depended upon the fact that the first cases treated were burns due to chemical agents but this belief was rapidly dispelled after using it for burns due to physical forces; and we have come to the conclusion that the etiological factor is of very little importance.

The method and technique is based upon the use of sodium bicarbonate which has given such excellent results in the hands of so many surgeons these last few years. The procedure is called by us the modified sodium bicarbonate method, since it is only applicable to burns with bullae or bleb formation, and is as follows:

A fair-sized needle, attached to a large record or similar syringe, is inserted into the bleb at its most dependent part and the fluid content of the bleb is withdrawn if possible. In large bleb formation several syringefuls may have to be removed. After all the serum possible has been removed the syringe is filled with a four per cent. solution of sodium bicarbonate and this is injected into the bleb until the latter is entirely filled with the solution. In certain cases the serum cannot be aspirated and it is then necessary to inject the sodium bicarbonate solution into the bleb, allowing it to mix with the contents and to remain in that location for a

few hours, when one will find that the combined material in the bleb can be easily aspirated. After the fluid has been withdrawn—that is either the pure serum or the admixture of serum and sodium bicarbonate solution—the bleb is filled with the chemical solution and it is allowed to remain for a period of from four to eight hours when the procedure is repeated. In severe cases this process is repeated several times. Great care should be exercised in order that the skin covering the blebs is not broken in aspirating or when the dressings are removed if dressings are necessary. To prevent the dressings from becoming adherent to the loose surface of the blebs it was found necessary that "ambrine" or paraffin gauze be used as this material gave by far the best results. When the secretions have ceased to form, a fine dusting powder, preferably zinc oxide, is used to cover the surface. In from five to eight days the epidermis in the form of dry scales is easily removed leaving a healthy dry surface giving the appearance of a sunburn.

By using this method we have found that the period of convalesence has been greatly shortened and that the dangerous elements so prone to occur with burns has been diminished. We have had no case of infection follow this method and though the number of cases is exceedingly small we believe that the incidence of this complication has been greatly lessened.

A CASE OF SEVERE LYMPHANGITIS OF THE ARM

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The patient, a married man of about forty-three years, was first seen March 1, 1919. He was well nourished, though his color was pasty and his eyes lacked lustre. This had been his usual appearance for several years past.

When he presented himself on the 1st day of March he had a carbuncle on the back of his forearm a little above the wrist. The trouble had started a few days before. The infected area was about the size of a twenty-five cent piece. It had not yet come to a focus, and as it is usually my custom to wait before incising for a separation of the slough, which corresponds in point of time to a shrinkage of the area of round cell infiltration, I ordered hot wet dressings for the time being. But by March 5th the red area had increased quite considerably and the patient was beginning to show signs of toxic absorption.

On this day under nitrous oxide, I incised the abscess, by a crucial incision, going a short distance beyond the indurated area into the healthy tissue.

I remember that I took particular pains in this case not to draw the knife blade from the infected area out into the non-infected tissue beyond, but started the cuts always from the normal skin, and cut half way across the abscess, then cleansed the knife in alcohol, and completed the cut by starting from the normal skin on the opposite side, joining the first half of the incision at the center. The same was done for the cross cut. Next the four flaps were dissected well up and packed under with sterile vaseline gauze.

The following day the wound was dressed, no further extension of the process had taken place.

On the 7th I was called to the house at five A. M. The patient had a rise in temperature, and severe pain in the left chest, about at the mid-axillery line. I saw him again at noon, and found him sweating. I could not make out anything definite in the lungs. At six P. M., he was still feverish and sweating and a cough had started.

On the 8th the temperature was 102.4° at 10 A. M. There was a marked increase in redness and swelling around the wound and the redness extended around to the flexor surface of the forearm. Still no definite sign in the lungs. At 6 P. M. condition the same.

On the 9th I sent him to the hospital in an ambulance. The redness had extended up the inner aspect of the arm to near the axilla. At 3 P. M., under ether (I think gas would have been better) I incised the inner aspect of the arm down to the level of the elbow, and extended the old cuts at the carbuncular site. No pus was found, but instead a serous fluid. The wound was packed with vaseline gauze and a wet boric dressing was applied.

On the 10th the temperature reached 102° and the patient was expectorating bloody sputum. While there must have been some lung involvement, it was not definitely found.

On the 11th the arm condition was apparently holding its own, and the patient on the whole was doing fairly well. But a blood count showed W. B. C. 27,000, and polynulears 97 per cent. The sputum showed type 4 pneumococcus.

Dry pleurisy was discovered in the right chest, and the lungs showed scattered areas where fine rales were made out, but the lung involvement was not apparently of a serious nature.

In the evening a pleuritic pain started in the left chest again, relieved by mustard, while the breathing was a little labored and 32 to the minute. At no time from then on did the lungs show definite

areas of consolidation and the patient complained of pain here and there and everywhere, with no special relationship to the findings. The respirations varied from 24 to 32, and cough and bloody sputum were present on and off.

On the 13th, two days later, the W. B. C. had dropped from 27,000 to 25,000 and the polynuclears from 97 to 85 per cent. But now the whole forearm was greatly swollen and getting very brawny and indurated. The surface was studded by many small elevated areas, in size from millet seeds to split peas, corresponding to the lacunae of the lymphatic vessels.

Under gas, parallel incisions were made on the forearm up the center and along the radial side. Only the same serous fluid exuded. The cut edges of the thickened skin showed great numbers of miliary abscesses, and in fact all the area of infected skin was teeming with these small abscesses. Pus from the areas showed pure culture of staphylococcus aureus and a vaccine was made. The skin could be dissected off the underlying structures very easily, and felt and looked like the skin of a salted ham. The hand was very edematous, and the fingers were extended and stiff. It was very evident that the skin and the skin alone, was the seat of a very severe process.

Until now his temperature averaged about 101°, and not especially of the septic type. The pulse averaged 90, although often of poor quality. For the next four days the patient was more or less restless and wakeful. He was given anodynes and supportive medicines and what food he could digest. Also his autogenous vaccine was given.

The dressings were changed twice daily. Vaseline gauze had been packed under the skin edges, but now dry dressings were resorted to.

By the 18th the brawny induration had extended above the elbow, 1/3 of the way up the arm. We now tried soaking the whole arm in one per cent. creolin solution, every three hours for half an hour at a time, and dry dressings applied between times.

By the 20th the infection had reached half way up the arm and it became of the bacon rind variety as on the forearm. Under gas more incisions were made above the elbow.

It was impossible to stand by and let the process extend on towards the body, without making incisions, yet anybody could see that while the small foci in the line of the cuts were opened, yet many thousand others, that lay in the skin between the cuts, were still unattacked, and to reach them one would have to slash the skin almost to ribbons, and yet not reach all of them.

After the last incision in the arm, the parts were covered by gauze soaked in Dakin's fluid, and wet these with every two hours. A secondary hemorrhage ensued a few hours later which stopped spontaneously, but necessitated the giving of a saline infusion to overcome shock.

At 3 P. M., the patient was seen by Dr. Ellsworth Eliot, who didn't think Dakin's solution was of much benefit for skin infections, but otherwise thought we were doing the best possible for the patient. At 4 P. M., a rectal drip was started, and continued at intervals during the rest of the day and night, and the following day.

At 8 P. M., the patient was seen by Dr. Goodrich of New York, by request of the family. He did not look at the arm but examined the chest, and thought he found some consolidation at both bases, but he couldn't decide whether the lung condition was a primary process, or secondary to the arm infection.

It was difficult for him, and had been for us for the past week, to examine the chest satisfactorily, as the patient could not be moved about much, the arm was now so large, heavy and sodden, and painful on manipulation.

The 22nd found us still using the Dakin solution, but by this time the brawny swelling had extended up to the axilla, and the arm was nearly twice its normal size. The patient was very restless and showed signs of severe toxic absorption.

On the 23rd stimulants were being pushed but the man was quite exhausted, though his mind was still clear. At 7 P. M., the patient was seen by Dr. Loevy, the celebrated French surgeon, from the War Demonstration Hospital of the Rockefeller Institute. He examined the arm carefully and suggested soaking the whole arm in a bath containing 10 per cent Dakin's fluid in sterile water, the arm to be kept in the soak three hours twice daily, and if that did not improve the condition, to apply a dressing wet with fifty per cent. alcohol in water. After the first Dakin's soak the patient felt chilly and exhausted, and later became a little delirious. We then used the 50 per cent alcohol treatment to the end.

From March 13th the temperature averaged only about 99.4° and the pulse 80 to 100, and the respiration 24 to 30. But from then on the curves have been greater, though the highest reached was only 101.2°.

The patient died March 28th, about thirty days from the onset of the carbuncle. The infection had reached the shoulder and was commencing to bridge across to the chest.

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WALTER M. BRICKNER, M.D., F.A.C.S., Editor

NEW YORK, JANUARY, 1920

CHRONIC MEDULLARY BONE ABSCESS.

Among the many soldiers who suffered gunshot wounds of the long bones (compound fractures in most cases) it seems likely that we shall encounter, as a late sequel—a residuum—of the infection, several instances of a condition that is but little described in our text-books of surgery and surgical pathology, and indeed, is not even mentioned in most of them, viz., chronic abscess in the medullary cavity.

As we have elsewhere pointed out* some of these chronic medullary abscesses of the long-bones, whether they contain but a few drops of pus or several drams, tend to become sterile and to run an afebrile course. In such cases the sole symptom is severe radiating pain in the extremity which is apt to be treated for "rheumatism" or "neuritis"; and the sole sign is localized bone tenderness.

Roetgenograms sometimes show clearly the site of the abscess in the medulla Often, however, the pus collection cannot be seen roentgengraphically, the appearance being only that of the ostitis or osteoperiostitis of the earlier process of which the abscess is the result. Sometimes the medullary cavity is much encroached upon or, in some places obliterated by the centripetal bone growth, and the central abscess may lie between two such points of medullary obliteration.

*Brickner: Chronic Medullary Abscess of the Long Bones, Annals of Surgery, April, 1917, p. 483.

These pus collections in the medullary cavity may result from osteomyelitis of hematogenous origin or produced by infection from without (e. g. gunshot wound). It would appear that occasionally they may also arise as a hematogenous process with little or no infection of the bone substance itself.

In cases of chronic sterile medullary abscess an extensive osteotomy for the pus evacuation is not only unnecessary but harmful. Simple trephinage with a small instrument—an operation that can be performed under nitrous oxid—quite suffices. The pain and tenderness disappear at once and, usually, healing takes place promptly. No other instrument and no drain should be introduced into the bone, lest a secondary infection be produced. A small gauze or rubber drain in the soft parts down to the bone is sufficient, and this only for a few days. If some dormant organisms should be aroused to further activity a secondary operation may become necessary but even then it will be no more, and probably less extensive than a primary osteotomy uncovering the entire extent of the pus collection.

Surgical Suggestions

The utmost gentleness in handling nerves is essential to good results in the surgery of those structures. Squeezing and pinching the nerve do fresh harm.

As J. Ramsay Hunt has pointed out, a paralysis of the ulnar nerve may develop *several years* after an elbow fracture, from inclusion in slow-forming scar tissue. After liberating the nerve it is wise to transplant it to a site where it will not be in danger of re-involvement by connective tissue or bone growth.

When operating upon the ulnar nerve in the elbow region be careful not to injure the muscular branches (to the flexor carpi ulnaris and flexor profundus digitorum) given off a little below the joint.

A bit of muscle (e. g. from the temporal) laid on the spot will promptly check bleeding from an abraded brain surface. A tear or small hole in one of the venous sinuses of the cranium can be definitively sealed by pressing upon it for a minute a piece of pericranium; it adheres like a postage stamp.

The application of heat and the administration of small doses of morphine are the two most important remedies in the treatment of shock.

Shave the skin before applying adhesive plaster, as on the chest; but do not shave the skin when applying adhesive plaster or glue for traction in the treatment of fractures.

Surgical Sociology

Ira S. Wile, M.D., Department Editor

DISPENSARY PROBLEMS.

At a recent meeting of the New York Academy of Medicine, there were presented certain facts regarding dispensaries which command attention.

It was pointed out that dispensaries no longer are to be regarded as simply places for the treatment of the destitute, but also as central stations at which may be secured special consultations and the advantages of group diagnosis. The principal difficulties in the administration of New York dispensaries, now costing approximately two million dollars a year, consist of a lack of uniform organization, undeveloped policies, and unsatisfactory executive work.

A plea was made for an improved administration from the time of registration to the discharge of the patient. This involves a higher standard of service on the part of registrars, a more up-to-date scientific equipment of dispensaries, and the adjustment of consultant service and hospital social service for purposes of diagnosis and therapeusis.

Standardized record cards are indicated as well as an improvement in the character of the service of clinic secretaries, whether paid or unpaid.

Numerous changes are demanded in order to secure a higher type of nursing personnel, and it is suggested that nursing in the dispensary constitute part of the training of pupil nurses In this connection it may be said that numerous benefits will accrue if dispensary service for physicians be considered an essential part of the preparation for promotion to positions upon the hospital staff

In a municipal plan of dispensary organization, it is essential that "districting" be tried in so far as may be possible, with a view to placing general clinics in positions of greater function. Numerous difficulties attach themselves to this scheme, but none the less it merits trial with a view to giving more valuable service to the community. It is obviously essential that public appreciation of the scope and function of dispensaries be secured, in order that adequate financial and moral support be secured to permit of better development of the dispensary system.

The growth of public interest in tuberculosis, obstetrics, venereal diseases, industrial handicaps, and infant mortality, has given rise to special expansions of efforts to control and limit the social penalties arising from these causes. Stress thus far has varied in different communities, some placing the emphasis upon the preventive work, and others dealing principally with curative measures. The most valuable service of the dispensary, however, is secured when the ideas of preventive medicine are in the foreground.

In a broad sense, the dispensary system potentially exists as a miniature Board of Health when disease prevention becomes its central thought. The expansions, therefor, of dispensaries are most valuable when they assume the character of preventive agencies, and through public health education raise the standards of health and vitality of the community they serve. This does not involve a decrease of interest in therapeutics, because obviously the relief of existent defects and handicaps serves also as a measure of preventing further deteriorations in the health of the clientele. The early recognition of incipient diseases and defects is attended with greater certainty of cure, and is productive of a higher vital return for the time, effort and money expended.

Dispensaries are now in a state of transition, accommodating themselves to the altering views of social practice along medical lines. The importance of social service departments is recognized and the necessity of linking up social service with dispensary practice is appreciated. The greatest advance in dispensary reorganization will depend, therefore, upon the further unification of social and medical practice and the direct attention to the problems of public health education in all directions. The problems of administration take their form from a realization of dispensary aims, and a recognition of the changing clientele now utilizing dispensary service.

The fact that the Committee on Public Health of the New York Academy of Medicine presents a report based upon an analysis of existing conditions, and emphasizes the value and need of a growth in policy and a revaluation of aims, is but a single indication of the general awakening to the tremendous possibilities of dispensary service in the movement toward an efficient public health system. From the standpoint of the general public, there is probably a greater advantage in a highly developed dispensary system than is to be found in mere extension of hospital practice.

Progress in Surgery

A Résumé of Recent Literature.

A Study of One Hundred Cases of Suspected Chronic Nasal Accessory Sinus Disease, with a Report of the X-ray Findings. HOWARD CHARLES BALLENGER, Chicago. *Illinois Medical Journal,* December, 1919.

Ballenger has studied the relative importance of the *x*-ray in the diagnosis of sinus disease. Twenty-eight of the one hundred cases were negative from the *x*-ray standpoint, and of these all but one showed no clinical evidence of sinus disease.

Of the seventy-two cases in which the *x*-ray revealed a cloudly sinus or sinuses, thirty-six were confirmed by surgical means, twenty-one were confirmed by clinical means other than surgery, four were post-operative—that is, plates taken from two weeks to six months after the sinus operation without unusual post-operative symptoms—leaving nine cases in which the sinuses were cloudy, but which showed no clinical evidence of sinus disease. Of these nine cases the plates showed part or all of the ethmoids cloudy in four cases. At the time of examination no evidence of ethmoid disease could be found, although all gave a history of having had former attacks of acute rhinitis, with a watery or a muco-purulent discharge.

The author's summary from these one hundred cases is as follows:

1. The chief difficulties in deriving the full benefits of the roentgenogram properly taken and developed is (a) reading the plate, that is determining the presence or absence of abnormal shadows or outlines; (b) having properly interpretated the plates the correlation of these findings to the clinical data obtained.

2. The *x*-ray is a valuable supplement to clinical diagnosis and when so combined, error in diagnosis is reduced to a minimum.

3. Valuable surgical information can be gained as to the presence of absence, size, shape, depth, etc., of the sinuses.

4. Thickenings of the mucous membrane of the sinuses due to former operations, infections, irritations, etc., will produce a cloudy appearance or an indistinct outline of the sinus in the plate.

5. As a guide to the post-operative progress the *x*-ray is of little assistance in the chronically diseased sinuses.

6. The *x*-ray is usually essential to determine the fact that the involvement is confined to certain sinuses, sinus or part of a sinus.

Suppuration and Gangrene of the Lung: A Study of One Hundred Cases. HARRY WESSLER, New York. *Journal of the American Medical Association,* December 27, 1919.

While abscess, gangrene and bronchiectasis are usually treated as rare clinical entities, they are becoming of more interest because of the increasing possibility of curing them by operative procedures. Wessler prefers to consider them together under the head of lung abscess or suppuration, and gives a tabulated etiologic classification of his 100 cases, showing the larger number to follow tonsillectomy or other operations, pneumonia or grip. There were six cases following aspiration, and two were tuberculous. Other causes were represented by single instances. They may thus be divided roughly into two groups: (1) those due to the aspiration of septic material into the bronchi, and (2) those due to the various primary lung infections, including frank pneumonias and the postgrippal cases. These two groups are not only distinct in their causation, but differ also in their symptomatology and pathology. This is evident, however, only in their early stages; and in order to recognize these differences, it is necessary to observe them from their inception. The immediate result of the lodgment of infection in the bronchus is to set up a localized bronchiectasis which later invades the lung tissue and then an abscess cavity develops. Suppurative lung conditions begin, whether postoperative or postpneumonic, as a sort of local bronchiectasis. Postoperative and aspiration abscesses are twice as frequent in the upper lobe as in the lower, while the reverse condition prevails with the postpneumonic cases. The physical signs are notoriously uncertain, but the symptoms are plain. In the aspiration cases, the onset occurs after two weeks of foul expectoration with persistent fever and usually slight hemoptysis. The distinction from tuberculosis should offer no difficulty, because of the absence of tubercle bacilli and the usual localization of the condition. Club fingers occur earlier than in tuberculosis and may be also a diagnostic aid. It should be emphasized that it is not necessary to demonstrate one or multiple cavities, and such occur only in a fair percentage of cases, and only the larger ones are usually discovered. The prognosis is best in the post-operative cases, but disappearance of symptoms should not be regarded as decisive. Symptoms disappear in many postoperative cases, but recur later. The prognosis of the post-pneumonic cases appears to be almost completely bad, but the patients may live for years unless complications occur, and some may enjoy considerable comfort. The medical treatment offers little hope; relief of the cough is an important matter. Acute lung abscess or gangrene of the lung is not usually an operative condition, but Wessler's studies of these cases show that in about one-third of the inspiration cases recovery takes place spontaneously in two months. Wessler has little faith in artificial pneumothorax in these cases. In two of the cases in his series in which it was performed, the trouble was aggravated and both patients died suddenly after the last insufflation. The importance of a bronchoscopic examination is emphasized, especially before operation. Except in cases of long standing, removal of a foreign body may effect a cure.

A Modified Operation for Scrotal Varicocele. SAMUEL R. MEAKER, England. *The Lancet,* November 29, 1919.

Meaker believes that in operations for varicocele, the correction of testicular ptosis by support or some form of suspension is more essential than the resection of veins. The author's operation, a modification of the Del Valle operation, omits resection altogether. He makes a longitudinal incision into the external spermatic fascia and cremaster muscle, and closes the incision by eight sutures longitudinally introduced, so that when they are tied the muscle is puckered and the testicle raised to the level of the root of the penis.

The advantages of the operations are:

1. It can be as easily and quickly done as the commoner operations for varicocele.

2. It is based on a sound anatomical principle.

3. It gives adequate and permanent suspension to the testicle, which is essential to a radical cure of this condition.

4. There is little or none of that plastic inflammatory thickening at the point of operation, which so commonly occurs in cases done by the old method.

5. The mobility of the intestine is not restricted by the formation of adhesions at this point.

6. The operation is not followed by congestion of the testicle or any other form of circulatory disturbance.

Convalescence is rapid. The patient gets up in a week, and permanently discards his suspensory in a fortnight.

The Pathogenesis and Treatment of Lympho-Sarcoma and Hodgkin's Granuloma. ISAAC LEVIN, New York. *Annals of Surgery,* November, 1919.

The author suggests that inflammatory lymphoma, Hodgkin's disease, and lympho-sarcoma may be different stages of the same disease, in spite of the fact that each presents a different pathological picture. Many cases show lesions of two or three of these conditions side by side. It seems most likely that Hodgkin's disease

does not begin in a normal lymphoid system. Tubercle bacilli or some other infectious agent produces an inflammatory lymphoma, and subsequently an unknown etiological agent transforms the latter into a malignant lymphoma. When all the types of cells within the gland proliferate, the condition is one of Hodgkin's granuloma. When, possibly as a matter of simple accident, one type of cells dominates over the others, there develops a condition of lympho-sarcoma. Lympho-sarcoma is no more identical with a true sarcoma than the Hodgkin's granuloma itself.

Hodgkin's granuloma and lympho-sarcomata are more promptly influenced by radium and *x*-ray than any other tumor. The affected lymph glands diminish rapidly in size, and with it there is a marked improvement in the general condition of the patient. Besides the affected lymph-glands, the spleen should be subjected to the same treatment. It is possible, when radium and *x*-ray treatment of Hodgkin's or lympho-sarcoma is begun early and kept up for a sufficient length of time, that the glands may be replaced by dense connective tissue. The treatment of these conditions should be continued for months. The opinion prevails that the action of the *x*-ray is only palliative and that ultimately the patients fail to respond to treatment. These unsatisfactory results are probably due to the fact that radium and *x*-ray treatment are attempted only late in the disease and not pursued with sufficient energy.

Inoperative Cancer and Other Conditions in Which Radium Is Indicated. WILLIAM D. HAGGARD, Nashville. *The Journal of the Tennessee State Medical Association,* December, 1919.

Some of the more important conditions treated by Haggard were all types of malignant growths, fibroid tumors of the uterus, enlarged prostate, lymphatic leukemia, leucoplakia, nevi—capillary, cavernous, moles, warts, papillomata, tuberculosis of glands, skin and joints, keloids and vicious cicatrices, lupus erythematosus, psoriasis, pruritus.

The results of radium treatment of sarcoma are, generally speaking, more satisfactory than in any other form of malignancy. If treated in the early stages, the results are most gratifying. These tumors should be treated by insertion of tubes directly into the tumor substance and by external radiation as well. It has been found that the best and most satisfactory results are obtained in lympho-sarcoma, and the disappearance of these tumors is marvelous. Sarcoma of the tonsil and post-nasal space responds most satisfactorily also. Melanontic sarcoma has been found to be less amenable to treatment.

From the author's own observations, and those of Young, Janeway, Kelly and others, he presents the following conclusions:

"1. The therapeutic application of radium is in its infancy, but indications are that its growth will be of increasing therapeutic benefit in the treatment of tumors, new growths, benign or malignant, and in the progress of certain other diseased conditions, as lymphatic leukemia, etc.

"2. It has been proven of value in the treatment of certain superficial diseases of the skin and mucous membranes, lichen planus, lupus erythematosus, cicatrices, painful affections of the skin, moles, papillomata, warts, angioma, pigmented nevus, rodent ulcers, epitheliomata, etc.

"3. Many benign tumors situated favorably are very satisfactorily treated with radium, as certain fibroids of the uterus, and some cases of adenoma of the prostate.

"4. Inoperable malignant tumors and growths are greatly benefited by its application. Sarcoma, best; carcinoma of cervix, next; and lymph-adenoma, carcinoma of lip, tonsil, esophagus, antrum and prostrate are sometimes best treated by radium.

"5. Radium used intelligently in conjunction with modern surgery and medicine will aid much in lessening the suffering and in lengthening the lives of many of our fellow-men."

Report of a Case of Restoration of the Bile Passage. JOSEPH D. COLLINS, Portsmouth, Va. *Virginia Medical Monthly,* December, 1919.

The following unique operation is of very great interest. The case was one of beliary fistula, following cholecystectomy in a woman; the obstruction in the common duct probably cicatricial in character. The essential feature of the operation was the dissection of the fistula in toto, and the use of the fistulous tract itself for anastomosis.

The operation in the author's words was as follows:

"The exposure of the common duct appeared hopeless. The tract of the fistula through the abdominal wall to the skin was completely dissected out. This fistulous tract became a well organized tube of connective tissue about one-quarter inch in diameter. A section of a No. 12 French soft rubber catheter was inserted into the open end of the fistulous tube for the distance of two inches. This was secured with one stitch of catgut. Four inches of the rubber tube projected beyond the end of the fistulous tube. At a point opposite the margin of the liver a stab wound was made into the duodenum. The fistulous tube with the rubber tube projecting from its distal end was turned into the lumen of the intestine and the stab wound closed with a purse string suture. The intestine was then drawn up and sewed after the manner of the Witzel operation. The anatomosis was further strengthened by sewing over it a tag of omentum.

"The abdominal wound was closed without drainage. Nothing was given by mouth for five days. On the third day a copious bilious stool was passed, the first for two months. Her recovery was quick and uneventful. The rubber tube was passed on the sixteenth day.

"Her digestion is normal and she is free from pain. She has gained thirty-five pounds in weight. She is apparently perfectly well. I realize that there is grave danger of cicatricial contraction in the fistulous opening into the intestine, with recurrence of obstruction. Just how long this fistulous tract, which is not lined with epithelium, will remain patent is problematical.

"A search through the literature disclosed only two cases where this method of repair was adopted, and both were unsuccessful."

Gangrenous Appendicitis Coincident with Labor. JAMES FRANCIS GRATTAN, New York. *Surgery, Gynecology and Obstetrics,* November, 1919.

Grattan, reports the first case in medical literature, of a patient operated upon for acute gangrenous appendicitis during the active process of labor. The author appends a detailed history of the operation, post-operative course and delivery. The outstanding features of the case were as follows:

1. A young woman, vigorous, primipara, normal obstetrical outlook, no complaints.

2. The simultaneous occurrence of early labor pains, with abdominal symptoms, ending in the diagnosis and operation for appendicitis.

3. The removal of a totally gangrenous appendix, filled with pus, and about to perforate. A beginning peritonitis of sero-purulent character.

4. The subsequent delivery of a normally formed and developed full-term baby and placenta. A state of apnea in the baby, lasting 45 minutes, with good pulse, followed by a normal period of three hours. The recurrences of the apnea, with normal periods between, finally ending in failure of the baby's heart action and death, seven and a half hours after delivery. The apnea was probably toxic from the pus in the mother's appendix.

5. Almost fatal post-operative complications of the mother—cardiac and renal failure, almost of fatal termination and undoubtedly of toxic origin from the appendix, and a subsequent jaundice, an effect of the toxemia upon the liver function.

6. Complete recovery without residual pelvic exudate, without cardiac, renal, or other residue, of the complications, and without invalidism of any kind.

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THE ADMINISTRATION OF ANESTHETIC IN HOME MILITARY HOSPITALS.*

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LONDON, ENGLAND.

From the beginning of August, 1915, to the end of July, 1916, I occupied the position of Consulting Anesthetist to the Malta Command, that is, during the period of the Gallipoli activities, when the greater part of the beds that the island contained were occupied by surgical cases. For the last fourteen months I have been in a similar position at home, and in that capacity I have visited all, or nearly all, the principal military surgical hospitals in England. In Malta, of course, all the *deaths under anesthetics* were notified to me, and since the middle of January of this year I have received detailed reports of all the fatalities in England, Scotland, and Ireland.

Most of you will recollect, I expect, that in the pre-war days I always deprecated the endeavor to use any one anesthetic, or any one method in every case, and insisted upon the advantages of varying one's procedure in accordance with certain elemental circumstances such as sex, age, physical condition, and nature of the operation. While my views upon this point remain unchanged, I appreciate the fact that the relative values of these respective factors have altered materially under the stress of war. Questions of age and sex have practically disappeared, and the main determining factors are those of the previous condition and the nature of the operation, and even these have very much altered.

DETERMINING FACTS.

First of all with regard to the factor of the previous condition, it seems to me that except for the secondary results of his injury, the soldier may be described as an average healthy male. But these secondary results are of much importance, and introduce, factors which are comparatively speaking unknown in civilian practice. For instance, with the acute shock of the battle-field we have but little to do in the home hospitals, but, on the other hand, very many of the men are suffering from a condition of *chronic shock* which renders them rather troublesome from the anesthetist's point of view. Then again, many of the soldiers have been the subject of a somewhat prolonged suppuration of varying intensity. This may not perhaps produce all or any of the characteristic objective symptoms of acute sepsis, but I am sure that it has a very bad effect upon the heart muscle. It is rather more than a mere coincidence that of forty post-mortems at home the heart muscle was found more or less degenerate in twenty-six, and of these twenty-six there were definite records of prolongd sepsis in twenty. A somewhat similar degeneration, too, results from malarial poisoning, to which the troops are exposed upon some of the fronts. *In Malta the question of the effects of malaria upon the heart muscle and its relation to death under anesthetic was the subject of an exhaustive inquiry by the authorities in that island.*

We do not, nowadays, hear very much about the so-called *soldier's heart,* which was the subject of so much controversy about the time of the Crimean War and after. I am myself inclined to believe, however, that *the dilated heart of over-training and under-feeding is of fairly frequent occurrence, and when by a rare chance such a patient comes under the anesthetic, trouble is very likely to arise.*

As regards the nature of the operation, the differences entailed by war conditions are so obvious that one need do no more than enumerate them. Intracranial injuries are usually treated at the base hospitals abroad, and we see but few at home. At any rate, I know that while I was in Malta such operations were of almost daily occurrence, but I do not think that I have seen a single one since I have been doing home work. Injuries involving the pleuræ are relatively numerous, severe, and complicated. Abdominal surgery, except in point of view of numbers, does not seem to me to differ from similar cases in civil life. *There are, however, at least three classes of case in which the work of the anesthetist has been most distinctly altered and severely tried. I allude to spinal injuries, orthopedic surgery in general, and plastic operations upon the face.*

Looking at the whole subject from a broad general point of view, I should be inclined to say that in military surgery the exceptional cases call more insistently for variations in methods of anesthetization than in civil life. But, on the other hand, the number of normal or straight-forward cases is relatively larger. This means of course that our first consideration is the selection of an anesthetic and method which may be employed almost as a matter of routine.

SELECTION OF ANESTHETIC AND ROUTINE METHODS OF ADMINISTRATION.

In deciding this question there are two very important points which must not be lost sight of. The first is the personality of the anesthetist. The additional military and war hospitals scattered throughout the country are to be numbered by hun-

* Read before the Royal Society of Medicine, Section of Anesthetics.

dreds, and the difficulty of supplying them with skilled or even efficient anesthetists is very great. The patriotism and willingness with which medical men and women have come forward to staff these hospitals are quite above any praises of mine, but I am sure that none of them will mind my saying that the task of administering anesthetic has not always been one with which they have been most pleased or for which they have considered themselves the best fitted.

The second point is that the large number of military hospitals taken in conjunction with the frequent and necessary changes in the anesthetists who work them, renders it very desirable to standardize the equipment provided, and to render that equipment as simple as is compatible with efficiency. The standard at present is:

(1) Nitrous oxid apparatus.
(2) Schimmelbusch's frame.
(3) Clover's inhaler.
(4) Junker's bottle (Rigby's safety pattern is now issued).
(5) Tongue forceps.
(6) Mouth gag.

One or more of each is provided in accordance with the size of the hospital and the number of operating theatres in use. For special hospitals, and where special cases are treated by special anesthetists, special instruments are obtainable. To my mind the War Office is quite generous in this respect, but naturally the authorities do not wish to lend themselves to the exploitation of cranks and instrument makers.

On the whole, therefore, one is bound to select as a routine anesthetic a method which is the least liable to abuse, and in the use of which the anesthetist, even if rather below the average, is least likely to go wrong. Amid conflicting opinions the task is not so easy as it seems. There is one negative point, however, upon which I hope my opinion may be largely supported—*i. e.*, that in military surgery at home the routine use of pure, unadulterated, or as our American colleagues call it, *straight chloroform*, as a first choice is to be avoided as much as possible. Briefly stated, my chief reasons are the following:

(1) In the hands of the most skilled the mortality is relatively high. I believe that it is something approaching 1 in 2,000. In military work I do not know exactly what the proportion may be, but I will give you some figure: *Of the deaths under anesthetics which have been reported to me since January, 1917, at least 55 per cent., and probably more, were due to or occurred under chloroform used in an undiluted form, and in many other cases the chloroform was by far the predominating drug. One may admit, of course, that in many of these cases the use of chloroform was almost imperative, and that in many the condition of the patient was such, that in all probability he would have died under any other anesthetic, but such admissions do not really affect the figures. I would further point out that of that 55 per cent., in fully 28 per cent. death occurred before any operation had commenced.*

(2) In the course of my wanderings, I have been much struck by the fact that of the most earnest advocates of pure chloroform, only a comparatively small number really know how to give the drug properly. As an example of this, let me instance the gentleman whom I found pouring drachm doses of chloroform upon a lint-covered Schimmelbusch's mask, over which, and his retaining hand, he had thrown another sheet of lint about the size of a pocket handkerchief. From the same hospital I received complaint of the impurity of the chloroform which, I was told gave rise to a great deal of lividity.

Although I object to the use of undiluted chloroform as a first choice, for routine work, it must not be supposed that my condemnation extends further than this. I fully recognize the value of this drug for many cases, and I would even say that when sufficiently diluted down with ether in the shape of one or other of the mixtures, and administered carefully by the open method it forms a very simple and admirable method of inducing anesthesia previous to the continuous use of ether.

For quite short cases some form of local anesthetic is, I believe, often employed, but these naturally do not come under my ken, and I have no means of knowing exactly to what extent this method is really employed. I am inclined to think, however, that it is not employed nearly to the extent that its most earnest advocates could wish, and for this I have no doubt that the surgeons could give sufficient reason.

For similar short cases an alternative is nitrous oxid. This is not used nearly so often as I should like to see it used. Two difficulties arise with regard to it. First of all the supply is somewhat scanty and irregular, and in the second place the average anesthetist in the military hospitals rather fights shy of it.

OPEN ETHERIZATION.

Failing local drugs and nitrous oxid, the anesthetic of my choice for continuous work is ether, and with certain reservations and precautions I prefer

the open method. The details of the particular method that I advocate do not, I expect, differ very materially from those employed by most of you, but in order to make myself quite clear, I will briefly refer to the points upon which I like to insist:

(1) A preliminary injection of morphin ¼ gr. and atrophin 1/100 gr. For military work I think that this should be given rather less than half an hour before the operation. In my opinion the orthodox one hour is too long. See, too, that the *patient* gets the full dose, not the bedclothes.

(2) A small pad of Gamgee tissue with a hole in it round the nose and mouth.

(3) A Schimmelbusch's mask covered with from twelve to twenty layers of gauze. This may be clipped to the pad by means of tongue forceps, and a useful hinge is thus formed.

(4) Although when time is no object and the surgeon is good natured, one can start with ether from the very beginning, I think that it is better in most cases partly to induce with a mixture, or even with a Clover's inhaler. In many cases I employ chlorid of ethyl on the open mask in the manner suggested by Dr. Barton.

(5) As a drop-bottle I recommend the metal flask devised by my friend, Dr. McCardie, of Birmingham. This enables one partially to regulate the flow of ether, and is therefore economical; it also possesses the great advantage of being practically unbreakable.

(6) The late Sir Frederic Hewitt introduced a very useful open airway tube passed into the mouth over the base of the tongue. I prefer to pass a smaller and softer tube about 5 in. down the nose, a device which I have found most useful, and now employ in almost every case.

This is the plan that I have advocated at most of the military hospitals which I have visited, and I believe that it is very widely adopted. The equipment of all military and war hospitals includes one or more Clover's inhalers, and at some of the hospitals I have visited I find that the anesthetist is rather wedded to that instrument and will not succumb to my blandishments in favor of the open method. Under these circumstances I generally suggest to him to try the plan proposed by Dr. McCardie of putting 1 dr. of chloroform into each 2 oz. charge of ether. I have myself had much success with this method, and believe it to be capable of extension in various directions, for instance, I am inclined to think that the same degree of dilution might be used by the open method all through, and would to some extent meet the objection so often raised as to the large quantity of ether required in long cases. In this connection I may perhaps say that from a large number of figures I have obtained I estimate that the quantity of ether required for open administration works out at 6 to 8 oz. per hour (in Malta it was to 8 to 10 oz.). Whichever plan has been adopted, I am very certain that less pure chloroform and more ether is being given in the home hospitals now than was the case twelve months ago. I think, too, that I can point to some definitely good results which have followed the change, for the death-rate for the quarter ending September 30 has been rather less than one-half of the average rate for the two quarters preceding.

ANESTHESIA FOR SPECIAL CASES.

I now come to the question of the anesthetic to be used in the various special cases to which I have alluded. *In the cases of modified or chronic shock to which I have referred I doubt whether one can give too much morphia, but in cases of sepsis, malaria and other heart trouble, I would avoid the use of morphia.* In other respects I would base my anesthetic treatment of all these cases upon three fundamental lines, viz.:

(1) Avoid all but the most dilute doses of chloroform.

(2) Give as little anesthetic of any sort as possible.

(3) Avoid anything like asphyxia, by diluting the vapor very freely. For which purpose oxygen given either by itself or bubbled through your anesthetizing agent is very useful.

It is in such cases as these that the use of the continuous gas and oxygen methods of the American surgeons seems likely to be of considerable value. Others who are here to-night will probably speak to you more in detail as to the particular advantages of this method. All I will say at present about it is that the present forms of apparatus seem to me to militate considerably against its general employment, nor am I quite convinced as to the quality of the anesthesia produced.

In discussing the question of a routine anesthetic I purposely avoided any allusion to the warm ether method, mainly because Dr. Shipway will probably speak upon that method, but partly because it does not appear to be used to any great extent at home, partly, also, because the method seems to me to lack that element of simplicity which I believe to be so essential when dealing with a large number of administrators of varying skill and capacity. I think, however, that in the class of cases with which I am now dealing—*i. e.*, chronic shock and sepsis, warm ether would very likely be of considerable advantage. *In intracranial cases, morphin*

is usually unnecessary, as the patient is often in a semi-comatose or dazed condition. For the same reason, too, very little anesthetic is required. In these cases I prefer chloroform because it is desirable to limit the venous congestion as much as possible. I usually administer it by means of a Junker's bottle, through which I pass a very small stream of oxygen, leading the mixture of chloroform vapor and oxygen down the nose by means of a soft tube.

The mortality arising from operations of the empyema type is rather heavy. Most of the cases dealt with in the home hospitals are of course of the chronic type, and have been the subject of prolonged and severe suppuration. They are, therefore, particularly bad subjects for anesthetics of any sort. There is no doubt that these cases ought all to have some form of artificial respiration as is typified in the intratracheal method. Unfortunately, however, my experience is that neither the anesthetist nor the surgeon seem always to grasp the seriousness of the problem which is before them when they decide to operate. The intratracheal apparatus is so cumbersome, costly, and difficult to manipulate that but very few establishments are equipped with it. Not only so, but the anesthetists are constantly changing, so that even when one man has learned to use it the probabilities are that he gives place to another in the course of a few weeks who does not know how to use the machine. I can only think that these cases ought to be concentrated in a few of the better equipped hospitals where this method is available. Failing this, chloroform and oxygen should be given very gently from a Junker throughout the operation.

In cases of spinal injury the position is often complicated by the fact that the patient is turned wholly or partly upon his face; this not only entails compression of the chest but obliges one to pump the anesthetic into him. Then again, avoidance of venous congestion is desirable. Taking all these points into consideration I am inclined to give these patients oxygen and mixture from a Junker's bottle. But these are cases in which the care and vigilance of the anesthetist are more important than the actual method employed.

One would imagine that orthopedic surgery was the special field for the use of the intraspinal methods, but I am surprised to find that, as far as my experience goes, this is not the case; nor is any explanation forthcoming. Nitrous oxid is frequently used, and it requires a good deal of skill in the manipulation of the administration to hit off the precise moment at which the fullest possible degree of relaxation is obtainable. The average orthopedic case does well enough with ether, but it must be ether given without a trace of asphyxia so that there is as little congestion of the veins as possible. At one of the orthopedic hospitals visited I received complaints about the amount of venous congestion, which in this instance was attributed to the use of warm ether, and unless the warmth of the ether vapor is very carefully regulated it does seem to produce considerable venous congestion.

ANESTHETIC FOR PLASTIC FACE SURGERY.

The question of the anesthetic in plastic face surgery and allied conditions deserves a whole evening to itself. It is one in which I have taken a great deal of personal interest, and one of the most difficult questions with which we have to deal. *The chief troubles arise partly from the presence of large quantities of blood in the mouth and pharynx, partly from the necessity of getting out of the way of the operator, and partly also from the difficulty in manipulating the anesthetic when the jaw is wholly or partly fixed, or even perhaps unduly mobile. There is no operation in which the anesthetist can be of so much real assistance to the surgeon, or where the value of a good anesthetic is so conspicuous.* For this reason I do not favor the view sometimes taken that one particular method should alone be employed. Not only do the cases vary very much in themselves, but one should take into account the capabilities of the anesthetist. In some few instances the ordinary routine methods are possible, but these are rather in the minority. In most cases exceptional methods will have to be employed. Of these exceptional methods I recognize four varieties.

(1) *The intratracheal method.* I place this first on the list, for just now it is very much in fashion. I acknowledge that in some cases it is almost indispensable, but I do *not* admit that it is necessary or even advisable in all or even in the majority of cases. Time, however, will not permit me to give my reasons for this opinion.

(2) Allied to this plan is what I would call *the intubation method,* by the means of a Kühn's tube. This method is little known in this country and I believe that it has many advantages, for the whole of the pharynx can be fully packed and the blood and mucus are then absorbed.

(3) Another plan which I also think is not as much practiced as it should be, is the *colonic ether-oil method* of Gwathmey. I have used it myself many times and seen it used by others, and always with satisfaction and advantage. It is probably

the simpliest known method of giving an anesthetic.

(4) The fourth plan—*the method of position*—is one I naturally esteem highly, as I am mainly responsible for its use in this type of case; but for that very reason I am not disposed to say much about it now. Anesthesia is induced with the patient sitting bolt upright on the table, any routine plan being adopted. The anesthesia is maintained by means of a nose-tube conveying oxygen and chloroform vapor; or the vapor of mixture or ether may be used. This plan has been sharply criticized, but at least I can say of it that it has been in use now for over a year at one of the principal "facial" hospitals in the kingdom, and that no fatalities have attended its use.

Whichever plan be employed, it may be supplemented by the use of some form of suction apparatus on the principle of similar tubes used by dental surgeons and with the same object—viz., the removal of blood and mucus from the buccal cavity.

ETHER BRONCHITIS RECORDS.

Before concluding what I have to say on the methods of anesthetization there are, however, two minor points to which I should like to draw your attention. The first of these is the occurrence of the so-called *ether bronchitis*. In the pre-war days one was very much inclined to put this down offhand to simple exposure, either in draughty passages or in the wards themselves. In my visits to hospitals of very varied type throughout the country, however, I have come across cases of bronchitis under such different conditions and surroundings that I am not at all sure that the theory of *exposure* will hold good. In some places it almost appears to be epidemic: in others it partakes of the nature of an epidemic; while in other places again where it ought to be rampant it hardly ever occurs. The second point is the question of records. In the original army scheme the only provision made for recording the work of the anesthetist was in the shape of one, or at most two rather narrow columns in the *operation book*. In Malta I drew up a form for this purpose, and from it I obtained some valuable information, the hospitals being all within reach and the operations not over numerous. A somewhat similar form is now in use too, in most of the English Commands. But I am not satisfied with the results; the figures do not appear so reliable. But at any rate I think that they have served one useful purpose—viz., that of increasing the interest of the men in their anesthetic work, something that is very desirable.

TRAUMATIC SHOCK AND ITS TREATMENT.*

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INTRODUCTION: Most surgeons are called upon at one time or another to treat cases of traumatic shock. As a rule, they are accidental cases occurring in the factory, street or railroad crossing. One finds all stages of shock in such cases and not infrequently, the surgeon has to act quickly to save the life of the patient.

As one would expect, traumatic shock was a frequent occurrence on the battlefield and although, both American and foreign workers have given considerable study to this problem, the results obtained were nevertheless of little value from a practical viewpoint. This, as will be shown in the text, was largely due to the fact that most of these investigators adhered to the theory of the nervous origin of shock, instead of the theory of the toxic origin of shock, long advocated by the author.

We also frequently witness manifestations of shock on the operating table, shown by patients during anesthesia. This is particularly true in operations of the stomach as well as general abdominal surgery. It is evident, therefore, that it is of the utmost importance to the surgeon to have a precise knowledge of the phenomenon of shock.

The anesthetist also needs to fully understand the nature of shock. In the first place, shock may be produced by anesthetics such as chloroform and ether. Secondly, shock may be developed after recovery from anesthesia. Finally, traumatic shock is regarded as a contra-indication for anesthesia. It is thus evident to what extent it is important not only for the surgeon but for the anesthetist as well, to fully understand the nature, etiology and pathology of shock and also the rational method for preventing and combating shock.

REVIEW OF LITERATURE.

There still exists much difference of opinion with regards to the nature of shock. Goltz, who, it will be recalled, produced shock by tapping the surface of the body of animals, regarded it as a vaso-motor reflex phenomenon. In our country after the Civil War three military surgeons, Weir Mitchell, Moorehouse and Keene, supported the Goltz theory of the nerve origin of shock. More recently physiologists working along this field, have also supported this view. Crile and Meltzer, while making a slight difference in their explanations, are practi-

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cally committed to the nerve origin of shock. Cannon (Jour. A. M. A., Vol. 70, P. 617, 1918) states that "Primary wound shock may come on so soon after injury as to be accounted for only as a result of nervous action, and as pointed out in the earlier paper, the individual with acidosis (is) sensitized so that operation, because still further increasing the acidosis and still further lowering the blood pressure, becomes hazardous. It leaves unsettled .... the occasion for the primary fall of pressure though the suggestion is offered that it may be of reflex character."

The nerve origin of shock has been accepted practically in toto by the Allied Medical Research Committee in England and The National Research Committee of the different universities of this country. The mode of treatment they recommend in wound injury and trauma, consisted largely of antiseptics and drainage. But the failure of this treatment is now generally conceded. Crowell finds no evidence of any permanent benefit following the injection of drugs in such cases. Armstrong expresses his belief that the value of antiseptics and drainage in trauma is entirely overestimated and Bainbridge reports in the U. S. Naval Bulletin (1918) that the use of antiseptics was definitely abandoned in favor of operative surgery.

THE WRITER'S THEORY OF SHOCK.

Some years ago while investigating cell necrosis I was led to the view that traumatic shock was caused by poisons or toxins liberated from the wound itself and my experimental and clinical studies in this field since that time, have furnished abundant evidence of the correctness of this view.

Briefly stated, in trauma we have destruction of tissue. This tissue is immediately attacked by enzymes, which cause it to undergo autolysis. During this autolysis split proteins are set free which are extremely toxic and when liberated in large enough quantities, cause traumatic shock. It is evident from this view that one of the primary considerations in the treatment of traumatic shock ought to be the removal of the devitilized tissue from the wound and thus prevent the poisonous split proteins from spreading destruction to normal tissue. This explains why surgery in traumatic shock is more successful than antiseptics and drainage. In the latter you have a slow process of killing the bacteria and removing the pus. If the antiseptic is too strong it only helps to bring about further cell necrosis. In surgery, however, the removal of the larger quantity of necrosed cells is brought about which minimizes the production of toxic split proteins.

Brachet brings out this point very forcibly adding "that while interventionists may sometimes have to regret the hypothetical preservation of a limb or one of its segments, conservatives often have to regret the loss of life." This is precisely what Du Bouys, one of the surgeons of the Revolutionary War, states, saying that "American Surgeons amputated at once and lost but few, but the French delayed and lost many." Larry, who was the first Naval Surgeon who cruised in American Waters (1787) and who afterwards became Surgeon in Chief of the first Napoleonic Army says, "I have lost a great number of soldiers, because although operated upon within the first twenty-four hours, yet the operation has been performed too late. It is then demonstrated that the "commotion" (shock) far from being a contra-indication to primitive amputation, ought to decide the surgeon in its favor. The effects of "commotion" (shock) far from being aggravated, diminishes and disappears after the operation."

Going back to the nature of shock, any agent capable of destroying tissue, may be an etiological factor of shock. Chloroform and ether cause cell necrosis and, therefore, produce shock or increase it when already present. My investigations amply explain why debridement not only removes the devitalized tissue from the wound, but prevents the poison of dead tissue from spreading cell destruction to the normal tissue. Primary suture restores the circulation of the injured part and puts a stop to further cell necrosis. This operative procedure promptly reduces the amount of cellular poison that is generated following the injury of tissue cells occurring in every wound. Crile (Canadian Med. Assn. Journal, Nov., 1918) mentions the biological importance of the effect of debridement and primary suture. He states "When the wound was surgically completed it contained many bacteria, but the obstacles to its biological defense had been removed. Then followed in natural sequence the usual "asceptic fever" and rise in blood pressure which is a good sign in recovery from shock." This clearly indicates that the presence of bacteria in a wound does not necessarily interfere with recovery from shock. Crandon and Ehrenfield are in entire agreement with my views, stating, "This reaction from shock is due to the absorption of decomposed products set free by disintegration of tissue." When these decomposed products of tissue disintegration become excessive and allowed to continue, death rapidly follows.

Although I consider surgery far superior than antiseptics in the treatment of traumatic shock. I

am not advocating the employment of surgery in all cases. Indeed, most of the cases of traumatic shock which I had occasion to treat, were restored without recourse to surgery. My treatment is both physical and biological rather than surgical, as is explained later. Before, however, taking up the subject of treatment, it will be well to discuss my experimental data on the nature of shock.

EXPERIMENTAL.

The traumatic shock syndrome follows whenever destruction of tissue takes place. In the laboratory shock may be produced by simple ligature, cutting off the blood supply of a part. The interruption of the circulation prevents the tissues below the ligature from being nourished. Cell necrosis promptly follows. The changes taking place in the cell and tissue under these conditions have been well described by Virchow. It is in this cellular disintegration with the formation of modified albumin in the tissue (Virchow) that we are most concerned in traumatic shock.

The following is a typical experiment which shows the relation between cellular disintegration products and traumatic shock. A ligature (Esmarch) was placed around the thigh of a dog and immediately a small portion of tissue was cut off from a point below the ligature. This tissue was at once frozen, cut and stained. On examination, cytoplasm and nuclei were found to be normal. A small portion of this fresh tissue was then rubbed up with salt solution and injected subcutaneously in the animal. No injurious effects were observed. The injured limb was allowed to remain for three hours quiescent with a view of bringing about cell necrosis with alterations in the tissue albumins. Again a frozen section was obtained from a point below the ligature. On examination of cytoplasm and nuclei, it was evident that necrotic changes have taken place. The stain was indistinct and vacuoles were present. An emulsion in saline was then prepared from this disintegrated tissue and small quantity of this emulsion injected subcutaneously into another dog. The syndrome of shock followed with fall in blood pressure, fall in temperature and death. Autopsy was immediately performed and the *most marked feature observed in this animal was splanchnic stasis.*

Furthermore, section of the liver, lung and upper alimentary tract showed that the blood had stopped in the pulmonary zone of lung, portal zone of liver and submucosa of upper alimentary tract. In other words, it was a complete blood stasis in the splanchnic area which is the true primary pathogenesis of shock as described by the writer in 1897.

Finally, after removing the ligature, the animal's leg was gently massaged with this view in mind, that the disintegrated or modified albumins of the necrosed tissue of the leg, be carried into the general circulation. Immediately there was a drop in temperature and blood pressure with shallow respiration; in fact all the syndromes of traumatic shock, the animal dying within a short while after this procedure.

THE RELATION OF TISSUE DISINTEGRATION TO TRAUMATIC SHOCK:

Animal	Character of Site of injury	Release of Ligature Hours after injury	Appearance of Shock Sym. Hours after release of ligature	Death Hours after Release of ligature	Time of Exam. After Sym. of Shock.
1. Cat	Mangled upper part of thigh.	2	2½	5	
2. Cat	Crushed lower part of thigh.	2	2¼	6	
3. Cat	Subcutaneous, clamp-thigh	1½	3	8	
4. Dog	Both thighs; constriction over ileac vessels	2	2½	7	
5. Cat	Crushing thigh	1	2		6 hrs.
6. Dog	Mangled upper thigh	2	3		7 hrs.
7. Dog	Crushing thigh clamps	1	2	9	
8. Rabbit	Mangled thigh	2	2½	6	
9. Rabbit	Extensive wound upper and lower thigh	1½	2	7	
10. Rabbit	Mangled thigh	2	2½	24	
11. Cat	Crushed thigh	1½	2	36	
12. Cat	Mangled thigh	2	2½		5 hrs.
13. Rabbit	Mangled thigh	2	3	24	
14. Rabbit	Crushed thigh	1	2		4 hrs.

This typical experiment clearly indicates that the shock syndrome embraces two distinct phases; first, the toxins liberated by the disintegration of dead cells; and secondly, the marked splanchnic stasis.

The fourteen experiments tabulated in the following protocol were carried out in a manner similar to the experiment reported above. After constricting the animal's leg with an elastic ligature, the injury was produced either by incision, mangling or clamps. Varying intervals were then permitted for cell necrosis to take place. The absorption symptoms usually appear soon after the release of the ligature, if cell necrosis is well established. In all

animals after shock syndrome was established, sections of the viscera were secured and immediately frozen, fixed and stained. The specimens were obtained in some cases before the death of the animal and in other cases after death.

The pathological findings in traumatic shock vary in degree but the primary change is the stasis observed in the splanchnic area, in the upper alimentary tract including the liver and lungs. This stasis is particularly noted in the portal zone of the liver; in the mucosa and submucosa of the upper alimentary tract and pulmonary arterial zone of the lungs. It is this congestion in the splanchnic area which is repsonsible for the fall in blood pressure and temperature and for the acidosis and metabolic failure. Examination of brain and nerve tissue immediately before or after death showed no changes which indicates that nervous manifestations play either a very small part or no part in the phenomenon of shock. "La Stupor" of Perigoff or "Topor" and "commotion" of Larry are secondary phenomena following the wake of the primary blood stasis.

It is perhaps well in this connection to point out that Raymonde, in 1909, tied off the circulation of the hind legs of a rabbit causing autolysis of the tissues. On reestablishing the circulation, there immediately followed dyspnea, rapid pulse, drop in temperature and other shock symptoms. Why shock followed in this experiment is evident from my above explanation. By interrupting the circulation, Raymonde caused autolysis of the tissue below the ligature and as the poisonous autolyzed products entered into the circulation, after releasing the ligature, the shock syndrome followed.

TREATMENT.

The above investigations clearly indicate that two factors underly the production of shock. The first factor is the blood stasis in the splanchnic area. It must be remembered that we are not dealing with mere congestion but with a state actually approaching coagulation. In other words, the circulation of the blood not only comes to a standstill in the splanchnic area, but that the viscosity of this fluid becomes so high, that on cutting a blood vessel in this area the blood will not run out, but will remain in the vessel.

The second factor is the production of toxins resulting from tissue disintegration. These toxins are produced by the action of ferments on the necrosed cells; shock being produced when these toxins enter the circulation.

It is evident, therefore, that the treatment in traumatic shock, in order to be successful, must aim (1) *to remove the blood stasis of the splanchic area and* (2) *to neutralize the toxins which are poisoning the patient.*

This is precisely the principle of the author's treatment. To remove the blood stasis in the splanchnic area, heat is employed. This is based on one of the principles of colloidal reactions. To illustrate: If gelatin is coagulated in a test tube, we can bring about a reversal of the colloidal reaction, *i. e.* we can cause the gelatin to become liquid again, by the simple application of heat. In the same way, by applying heat to the partly coagulated blood in the splanchnic area, we help to cause the blood to become fluid again.

In cases of shock, heat to be effective must be applied as nearly in direct contact with the splanchnic area as possible. The application of hot water bottles to the surface of the body is too remote to be of value, even though they are applied to the abdominal wall. I have long advocated the use of small thin rubber hot water sacs introduced into the abdomen during surgical operations. The rubber surface is preferable to the injurious gauze, as it causes less trauma to the peritoneum and provides a more constant heat, which to be effective must be of high temperature as well as directly applied.

Where the abdomen is not opened the next approach to the splanchnic area is through the stomach. The small rubber sac described is attached to a double recurrent rubber tube and introduced into the stomach. The heat is maintained continuously by a constant infow and outflow as I described in 1896. The heat not only reaches the liver by the gastric veins but the thoracic area through the esophagus is more or less directly affected, thus preventing stagnation in the lung capillaries. These methods can be used throughout surgical operations and have been found to lessen the danger from anesthesia.

The colon is the next valuable avenue for heat application for the splanchnic area. Hot water introduced into the colon during surgical operations is not always practicable, but the small hot water bags introduced into the colon can be beneficially used, though heat applied here is not always as effective as by the more direct route, the esophagus and stomach. I have for many years advocated the use of the continuous irrigation of the colon (with the double recurrent tube, giving water of high temperature followed by cold; then repeated) in operative or accident cases and infections of various types. As a control to regulate the amount of water the outlet tube is connected with a

vacuum bottle at the bedside which does not allow the colon to be overfilled.

The heat and absorption of the water have been shown to be of great value in all cases of shock and infection. The idea of the absorption of water alone without the heat led to the adoption of this method as the "Murphy drip." The danger of the injection of water by the colon, subcutaneously, or intravenously, was shown early in this work, and hence caution must be maintained by the proper dosage of the fluid intake. The value of this continuous fluid absorption and persistent heat within the abdominal area with the hot water bag will be more appreciated now that we know through our researches in colloidal chemistry that heat dissociates an absorption compound which occurs in the "colloidal complexes" in the animal organism in shock and infection. The application of heat to the soles of the feet has the advantage of being more direct in affecting the splanchnic area than when applied to the trunk, for the blood in the plantar veins when heated is carried directly by anastomosis through the hemorrhoidal vein into the splanchnic area, and portal vein of the liver.

Having outlined my procedure for overcoming the splanchnic stasis, our next problem is to neutralize the toxins which result from cell necrosis. This is brought about by the employment of a specific immune horse serum. The serum is produced by immunizing horses with properly prepared human autolyzed tissue protein. My procedure is described in detail in another place.* Suffice it to say in this connection, that if autolyzed human tissue is injected into horses from time to time, for a period of about six months, the animals develop in their blood specific antibodies against human products of tissue autolysis. Such immune serum, when subcutaneously injected in patients suffering from traumatic shock, has given, in the hands of the author, remarkably favorable results.

It will be recalled that the underlying difficulty in cell necrosis, is the fact that iso-autolyzed tissue resulting from the necrosed cells, enter the circulation and poison the patient. A serum therefore, which contains antibodies against human autolyzed tissue is, in the opinion of the author, the only logical treatment against the poisonous autolyzed tissue resulting from cell necrosis.

SUMMARY.

Traumatic Shock, according to the author, is the result of two underlying factors. (1) Marked stasis in the splanchnic area. (2) Toxemia resulting from autolization products of Cell Necrosis.

The method of treatment is primarily directed against the above two factors. (1) The splanchnic stasis is overcome by heat, in accordance with a well established principle of colloidal reactions. (2) The poisoning caused by products of cell necrosis is overcome by means of an immune serum which contains antibodies against human autolyzed tissue.

14 EAST 53rd STR.

* Medical Record March 2d, 1919.

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THE AMERICAN ASSOCIATION OF ANESTHETISTS WILL MEET IN NEW ORLEANS, APRIL 26-27, 1920, THE FIRST TWO DAYS OF A. M. A. WEEK. THIS—THE EIGHTH ANNUAL MEETING—WILL BE THE FIRST ANESTHETIC RALLY EVER HELD IN THE SOUTH AND IT IS HOPED THAT SOUTHERN ANESTHETISTS WILL PROMOTE THE INTERESTS OF THEIR SPECIALTY BY CO-OPERATING IN MAKING THIS MEETING A SUCCESS.

THE FOLLOWING WELL-KNOWN AUTHORITIES HAVE ALREADY CONSENTED TO PRESENT PAPERS—DRS. ALBERT H. MILLER, JAMES T. GWATHMEY, E. M. PRINCE, ANDRE CROTTI, CARROLL W. ALLEN, WALTER LATHROP, ANSEL CAINE, GEORGE PINESS, JOHN J. BUETTNER, E. I. McKESSON.

FOR FURTHER INFORMATION, APPLICATIONS FOR MEMBERSHIP AND PLACES ON THE PROGRAM, ADDRESS F. H. McMECHAN, M. D., SECY, AVON LAKE, OHIO.

EXPERIMENTAL SURGICAL SHOCK.*

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It is my purpose to review briefly in this article the results of the investigations of experimental surgical shock with special reference to those phrases that have a bearing on its relation to anesthesia. While the review is not complete, it will include what is now considered the most important conclusion with regard to the condition.

Very few subjects have received such renewed impetus for investigation as has surgical shock. When I first became interested in shock in 1912 there were not fifty articles dealing with any phase of the subject in a comprehensive manner. In the last few years the number has more than quadrupled, and in the enormous amount of work that has been done a few new facts of great importance have been discovered. Much of the recent experimental work, however, has been a reduplication of the work of earlier investigators. There are still many unsolved problems in connection with the condition which the surgeon diagnoses shock.

In order intelligently to evaluate the results of experimental investigation of surgical shock, two points, which I have repeatedly emphasized, should be noted. (1) The condition termed shock by the surgeon is undoubtedly due to a large number of causes, and (2) experimentally it is very difficult to reproduce the environment and all the phenomena which the surgeon calls shock. [8] [9] [10] [11] and [12]. While the clinical picture and the resulting condition may be quite similar, the causative factors are undoubtedly different in many of the cases diagnosed as shock. The experimental production of a condition which fulfills the clinical diagnosis of shock is very limited and it must be conceded that experimental investigation has duplicated but few of the conditions of shock which the surgeon sees. In general, most of the experimental work has concerned the methods of production and treatment of low blood pressure.

THE ANESTHETIST AND SHOCK.

The anesthetist is interested in surgical shock because, (1) a patient may develop the condition during or following operation, and (2) it may be necessary to give an anesthetic to a patient already in shock. The experimental investigator has been able to learn more of these problems in which the anesthetist is interested than of many of the other conditions which the surgeon terms shock.

The possible causes of a patient's developing the clinical sign of shock during or immediately following an operation may be included in four groups: (1) preoperative condition, (2) anesthetic, (3) trauma and exposure incident to the operation, and (4) hemorrhage. Other factors are involved but most of them fall within one of these divisions.

It is well known that the preoperative condition determines, largely, the manner in which a patient will react to procedures incident to an operation. There are some experimental data concerning this. For instance the clinical observations have been parallelled to a certain extent by the finding that dogs with distemper will develop the signs of shock after exposure of the abdominal viscera sooner than normal animals, [5] [14]. A fat patient usually withstands operation poorly, and it seems to be true after abdominal traumatization that a very fat dog will develop the sign of shock more readily than a normal one. The poor reaction of the patient who has been purged intensively may seemingly be reproduced experimentally in animals.

The effects of the anesthetic and its relation to shock are complicated [10] [13]. In general their relationship depends on the direct action of the anesthetic and the indirect results of its action. Both of these depend on many other factors, such as the kind of anesthetic, the method of administration, the amount of the anesthetic, and the depth of anesthesia. Low ether tensions, just sufficient to produce narcosis, will not lower the blood pressure in a normal animal even after many hours, and they do not, as nearly as could be determined, predispose the animal to shock. The signs of shock can readily be produced by high tensions of ether. Furthermore, an animal that has been deeply etherized for a short time will develop the signs of shock following exposure of the abdominal viscera seemingly quicker than a normal animal.

The relation of shock to the trauma and to exposure incident to the operation depends on many factors. The most important of these are the site of operation, the character of the operation, and the duration of the operative procedure.

Hemorrhage is a factor which complicates a majority of clinical reports of shock. While many undoubted cases of surgical shock occur in which hemorrhage could not have been a factor, it has been present in many cases. I have been able to demonstrate this relationship between shock and hemorrhage from the experimental standpoint [8] [9].

The question of whether a patient in shock should be given an anesthetic and operated is still unsettled. Anesthetists and surgeons of large ex-

*Read during the Seventh Annual Meeting of the American Association of Anesthetists, at Atlantic City, June 9-10, 1919. From the Division of Experimental Surgery and Pathology, Mayo Clinic.

perience may be found on the affirmative and on the negative side. The experimental investigator has not been able definitely to settle this question but the weight of experimental data seems opposed to operative interference in shock when such interference is not absolutely essential to save life.

CORROBORATION OF EARLIER CONCLUSIONS.

In general, my earlier conclusions with regard to experimental shock have been corroborated in the whole or in part by recent investigators. Briefly, the most important of these conclusions are:

1. Clinically, certain cases of shock develop so quickly after the exciting agent that it seems the condition can only be due to a primary impairment of the nervous system. So far it has been possible to produce such a condition experimentally in but a few instances, and in these the experimental production was associated with inhibition. It would seem that inhibition is of more importance than excitation.

2. A condition simulating clinical shock, which developes sometime after the exciting agent, can be produced experimentally by diverse means. The only method which could be comparable with regard to precedure is by exposure of the abdominal viscera. Of such a condition produced experimentally the following facts are known: (a) The vasomotor center is not the primary cause, although it is probably impaired by the condition of low blood pressure[6 8], (b) the cardio inhibitory center is not primarily impaired[8], (c) the heart is capable of performing its work if enough blood is supplied to it although it undoubtedly is affected by the long continued condition of low blood pressure[2 8], (d) the condition is not due to a primary disturbance of respiration[8], (e) the condition appears to be due to a loss of circulating fluid[8 9], (f) the process as determined in the condition of experimental shock produced by exposure of the abdominal viscera can best be described by quoting from one of my previous articles[10].

"When the great delicate vascular area of the viscera is first exposed to the air, changes of temperature and handling, there is an immediate dilatation of all the arterioles in the exposed area. Rarely a short period of construction precedes the dilatation. As a result of this dilatation of the splanchnic arterioles blood pressure decreases. The splanchnic capillaries and veins are markedly distended, which may be due to one or all of the following causes: A local inhibition of vasomotor tone, an active dilatation, changes in abdominal pressure, and venous obstruction. On the whole, the process resembles the first stage of acute inflammation and does not appear to differ essentially from the phenomena as observed in the classical experiments on the subject. After this initial fall in blood pressure the condition of the animal may remain stationary or even slightly improve. However, as the loss of tone and paralysis of all the tissue involved take place, the blood pressure progressively falls, the temperature becomes subnormal and the animal develops profound shock. The loss of circulatory fluid and changes in temperature quickly imperil the life of the cells of the rest of the organism and death usually results from anemia of the medullary centers, particularly the respiratory. At the time the viscera are exposed and during the period that shock is developing, the vasamotor center increases in tone and the untraumatized arteries constrict. The amount of this constriction depends on their previous condition and the degree of splanchnic dilatation. During this time the center will usually respond to reflex stimulation and asphyxia, which demonstrates that it is still active although not functionating to its maximum extent. When the state of shock is fully developed it is usually, but not always, possible to obtain a response of the center, due to the long-continued low blood pressure or to the fact that all untraumatized arteries are constricted to their maximum extent, or that the great splanchnic area through which most reflex responses of blood pressure are produced is completely paralyzed."

Several important advances have recently been made in the treatment of shock, both by clinical and experimental investigation. I shall briefly review some of my previous work on the subject [11 13].

The treatment of shock may be divided into (1) general measures, (2) use of drugs, and (3) attempts to restore fluid volume. Some of the general measures, such as applying heat, etc., are universally practiced and both clinically and experimentally have been found of value. The use of drugs either the stimulants, of which strychnin is an example, or the vasoconstrictors, such as adrenalin, has not been shown to be of much value in experimental shock. An anesthetist's careful investigation of the use of these drugs in known and controlled cases of shock would be of great value. Many artificial fluids have been developed for infusion in the treatment of shock. Chief of these are (1) sodium chlorid, physiologic and hypertonic, (2) sodium bicarbonate or sodium carbonate (Fisher's solution)[8], (3) glucose, (4) sodium sulphate, (5) cane sugar, (6) gelatin (Hogan's solution)[7], (7) acacia (Bayliss' solution)[1], and (8) combinations

of these, as acacia, glucose, and sodium sulphate [13], acacia and glucose[2], etc. It may be concluded that the so-called colloidal solutions, those containing acacia and gelatin give the best results; the addition of glucose to the solution definitely emphasizes its value. The alkalin solutions are of more value than physiologic sodium chlorid solution, and a hypertonic sodium chlorid solution produces better results than a physiologic one. None of the artificial solutions produce as good results as blood. Experimentally blood serum has given as good results as whole blood.

Discussion.

From this brief review of the known facts concerning experimental surgical shock and its treatment, and from clinical investigation, it seems that the following discussion of clinical shock is justified.

All cases of shock may be divided into two general groups: those which follow immediately after the exciting agent, and those in which a time interval occurs between the development of the condition and the trauma.

It would seem that most of the cases in the first group, which includes most of the classical examples of shock given in the literature, are dependent more or less primarily on a reaction of the nervous system. If the primary factor in these cases is the nervous system, inhibition would seem to be of more importance than excitation. I have shown experimentally that under certain conditions inhibitory stimuli will produce death. It is reasonable to suppose that under various other conditions and other stimuli an acute condition can be produced.

The primary factors of a majority of cases of surgical shock are quite varied but a uniform end result is produced which probably accounts for their common symptoms. This end result seems to be a loss of circulating fluid. Under normal conditions the changes in the permeability of the cells, their water content, etc., are such that a sufficient and practically constant volume of fluid is furnished the blood. The mechanism of fluid volume is so regulated that the fluid intake, fluid outgo, mass of circulating fluid and fluid content of the tissue cells are mutually interdependent. Changes in any of these factors must throw into action a mechanism which attempts to compensate for these changes. In shock we may have any one or more of these factors primarily or secondarily involved and it seems to me that most of the known facts of experimental and clinical shock can be explained in terms of impairment of these factors.

A few instances are cited in which a decrease in fluid intake apparently is of importance in shock. It seems to be a clinical fact that patients who have vomited persistently before operation do not react well after operation. From my experiments it appears that the withdrawal of fluid for a few hours before beginning an experiment predisposed the animal to shock. Further data is being obtained on this point. In contrast to this one may compare the patient who receives a hyperdermoclysis or proctoclysis during or immediately after operation.

There are a few instances of changes in fluid output which may have a bearing on shock. It is a well known observation that in experimental shock due to exposure of the abdomnial viscera a large amount of fluid is lost from the exposed visceral surface. This no doubt plays but a slight part in clinical shock. The poor reaction of the purged patient is probably due to the loss of fluid. The fluid lost through excessive sweating of the patient undergoing operation is also a factor in shock.

Probably the majority of cases of surgical shock are due to a decrease of circulatory fluid brought about by external loss (hemorrhage) or an internal loss following damage to tissue cells. I believe then an explation of most cases of shock will involve one or both of these factors.

The relation of external loss of fluid (hemorrhage) to shock has been repeatedly discussed but it is of so much importance that it should be reviewed, briefly, at least. I have shown that a hemorrhage during anesthesia will produce all the signs of shock except, in some instances that of low blood pressure[8]. Furthermore in shock due to exposure of the abdominal viscera the loss of circulating fluid is sufficient to produce all the signs of shock[9]. Both of these findings have been corroborated [4]. It would seem that the common symptoms of shock and hemorrhage are dependent on the common loss of circulatory fluid.

Shock and Hemorrhage.

Recently I have performed some experiments which again emphasize the relationship between shock and hemorrhage. If an etherized animal is bled repeatedly of a small amount of blood it is found that at first each hemorrhage produces a slight decrease in blood pressure which is quickly corrected. However, as the small hemorrhages are repeated a point is finally reached at which the pressure does not fully recover, and later does not recover at all; there is a total failure of compensation of the vasomotor mechanism and the mechanism for controlling fluid volume. If only one or two small hemorrhages are produced and the abdominal viscera are then exposed for a short time it is found that although compensation occurs before the

trauma it does not afterward. The exposure of the abdominal viscera produced the same effect as the repeated hemorrhages. If the abdominal viscera of an etherized animal are exposed for a very short time and then replaced the condition of the animal remains good and shock does not develop. However, if at the time the viscera are replaced the animal is also bled a small amount, much too small to produce a permanent effect by itself, the animal is very apt to develop the symptoms of shock. The experiment may be varied by substituting some other procedure, such as deep etherization, for the abdominal trauma and the small hemorrhage will usually produce a marked effect.

These experiments would seem to show that the effect of hemorrhage depends in a large measure on various factors. A combination of deep anesthesia, operative trauma and hemorrhage is probably the most common cause of operative shock.

Internal loss of tissue fluid due to tissue injury seems to be a most potent cause of shock. When body cells are damaged their ability to control their water content and permeability seems also to be impaired. If the amount of tissue damaged is sufficient the entire mechanism for controlling fluid volume is impaired and the decreased circulation produces all the clinical signs of shock. It seems that many forms of tissue injury will produce this result. The initial factors may be quite varied. As was previously stated, in experimental work a decrease in blood supply to a relatively large volume of tissue is the most common factor. Excessive heat and cold also will damage tissue and produce shock. The employment of drugs, toxic substances, probably some even arising from injured tissue cells themselves, will produce the same end result[12].

BLOOD PRESSURE.

Few surgeons will make a diagnosis of shock in a case in which a low blood pressure is not present and it is undoubtedly true that the low blood pressure is the most important complication to treat. Nevertheless, as Meltzer first pointed out, a patient may have all the signs of shock without a low blood pressure[15]. I was able to produce such a condition experimentally both by exposure of the abdominal viscera and by hemorrhage[8]. These results have been corroborated[2 4]. It seems that in such cases vasomtor compensation has been able to maintain blood pressure against the decreasing blood volume, although at the expense of the blood supply to the tissues.

POSTOPERATIVE SHOCK.

Probably no better example of the application of the data and theories derived from the work on experimental shock can be made than an attempt to explain the failure of reaction after operation which is termed postoperative shock. Such a condition is undoubtedly quite complex but a partial analysis of the possible factors involved can be made; it may best be discussed by a consideration of the factors involved before operation, during operation and after operation.

Before operation the most important points to consider are those discussed under fluid intake. If the fluid content of the patient is not up to normal, due either to factors associated with the pathologic condition present, vomiting, fever, etc., or to faulty preparation, purging, etc.

During operation the most important factors enter. The anesthetic is of great importance and may aid in producing the condition either by the direct depressing action of the drug, or by the indirect result of this action. The direct action produces depression of the circulation and respiration and a loss of muscle tone. These in turn produce a decrease in tissue nutrition and resulting tissue damage. The amount of damage seems to be proportional to the initial irregularities of the anesthetic and the depth of anesthesia. Hyperpnea and asphyxia are to be considered but probably most important is whether or not the anesthetic is pushed to the point where a decreased respiratory pump and loss of muscle tone fails completely to return the blood to the right side of the heart.

The part operative trauma plays varies but in general it is proportional to, (1) the degree of hemostasis, (2) exposure of the abdominal viscera, (3) changes in normal pressure relations, as opening abdominal and thoracic cavities, and (4) the production of nerve reflexes.

Postoperatively the most important factors are restoration of fluid volume, and elimination of the anesthetic. From the experimental standpoint it seems to me that the most important result of administrating carbon dioxid is the stimulation of respiration, thus more quickly eliminating the anesthetic.

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A STUDY OF THE TOXIC EFFECT OF GENERAL ANESTHETICS IN NATURALLY NEPHROPATHIC ANIMALS; AND PREVENTION OF THE TOXIC ACTION.*

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During the past few years several investigations have pointed out the frequency with which naturally acquired nephropathic processes occur in the kidneys of dogs. Such observations have been made by Ophuls[1], by Pearce[2], and more recently by Dayton[3].

A few years ago a rather extensive study of these naturally nephropathic processes was taken up in this laboratory, with the object in view of classifying such conditions and in the second place of studying the naturally acquired kidney injuries from a point of view of the physiology of the kidney and finally for using such material in which to produce some acute injury by various nephrotoxic agents.

In the purely pathological study, this chronic kidney material was found to fall in a general class of chronic kidney injuries, in which a productive inflammatory reaction occurs, leading to some form of secondarily contracted kidney. In two of the animals, the changes in the kidney, coupled with the changes in the vascular tissue of the kidney and the vascular changes in general, permitted a classification of the kidneys from these animals as primarily contracted kidneys.

In the first and larger group of chonic nephropathies, the initial injury appeared quite clearly to take place in the glomeruli, leading to a chronic glomerulo nephritis. In such lesions it was impossible to separate the capsular from the intracapillary changes. In these kidneys the tubular epithelium was well preserved. This observation of the lack of correlation between the degree of chronic glomeruli injury and tubular injury has very recently been pointed out by Stengel, Austin and Jonas[4], as occurring in certain chronic nephropathies in human material. From this very brief account of the chronic naturally acquired pathology, this group of animals, it will be seen, offers an excellent opportuniity to study the functional capacity of the kidney when its vascular mechanism is severely injured with the epithelial element of the kidney only slightly participating in the damage, and the material also furnishes the opportunity of studying the effect of the susceptibility of the kidney to certain injurious agents, such as anesthetics, not only from a pathological point of view, but from the standpoint of the kidney's function.

Observations of Naturally Nephropathic Animals Prior to an Anesthetic.

Twenty-one animals have been used in this series of experiments. The animals were kept in metabolism cages, given 500 cc. of water daily by stomach tube, and fed on a diet consisting of bread with a small amount of cooked meat. The urine was examined twice in each 24-hour period. The examination consisted in the ordinary qualitative examination for albumin, acetone, diacetic acid and the centrifugilized urines were examined for tube casts. The Marriott methods were used in determining the reserve alkali of the blood and the carbon dioxid tension of alveolar air.

Blood urea examinations were made by the method of Marshall, as modified by Van Slyke and Cullen[5], and the phenolsulphonephthalein test was conducted according to the method outlined by Rowntree and Geraghty[6]. These examinations have shown a trace of albumin in the urine from the various animals. The number of casts in the different urines has varied very much—from only a few hyaline casts in several fields to numerous granular casts in the urine of other animals. The urine failed to show either the presence of acetone or diacetic acid. The reserve alkali in all of the animals, with one exception, has varied within the range of normality—from 8.0 to 8.15. In the exception to this, the reserve alkali was 7.9, and it is of some interest that the urine of this animal showed the largest amount of albumin—1.2 grams —and the casts in the urine were very numerous and principally of the granular type. The carbon

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dioxid tension of alveolar air has shown a correlation with the reserve alkali of the blood. The blood urea determinations have varied from 0.015 to 0.028 per cent. The output of phthalein has varied from a minimum of 52 to a maximum of 69 per cent.

From the above outlined findings, taken in conjunction with the pathology of the kidney as shown at autopsy, it seems permissible to conclude that these animals had a chronic glomerulo nephritis resulting in a type of secondarily contracted kidney, which is comparable not only in its pathology but in the blood of urine findings with similar conditions that occur in the human material.

The animals of this group were anesthetized either by morphin-ether, or by Grehants anesthetic—the active anesthetic constitutent of which is cloroform. Each animal so anesthetized was controlled by a normal animal that had been subjected to the same examination as outlined for the nephropathic dogs. The anesthesia for the control and nephropathic animals lasted 1½ hours, and at each half-hour interval during the anesthesia the urine was collected and measured, and the blood of the animals examined by the method indicated for its reserve alkali content. At such half-hour intervals, different diuretic substances were given the animals, and their effect on the functional response of the kidney noted in the output of urine during the following half-hour period. The diuretic solutions employed were as follows:

Theobromine, 1 per cent.
Caffine, 1 per cent.
A 0.9 per cent solution of urea.
A 20 per cent solution of glucose.
Pitruitrin 0.5 cc. per animal.

The difference in response of the normal control animal, as compared with a naturally nephropathic animal during the course of the anesthesia, is very striking. All of the control animals were freely diuretic after the establishment of a satisfactory state of surgical anesthesia. The output of the urine varied from two to eight drops per minute. The reserve alkali of these animals and the tension of alveolar air carbon dioxid was normal at this period of the anesthesia, and remained normal for the hour and a half of the experiment.

When such animals were given any of the diuretic solutions previously mentioned, there occurred an increase in the formation of urine. The output was greatest from the glucose, and from the pitruitrin.

When a similar degree of surgical anesthesia had been produced in the naturally nephropathic animals, the result was a harp reduction in the output of urine. Only one of the animals was forming urine at this early stage of the experiment, and the output in this animal was only two drops per minute. The remainder of the naturally nephropathic animals at this period of the experiment had become anuric. During the course of the experiment, the reserve alkali of the blood showed a progressive reduction in all of the animals, so that by the end of the hour and a half period of the experiment, the reserve alkali readings varied between 7.8 to the very low figure of 7.45. During this period, the same diuretic solutions were given these animals as were administered to the control animals. The nephropathic animals which at the commencement of the experiment was forming two drops of urine per minute, responded half an hour later to the theobromine with an increase of urine to ten drops. All of the other animals remained non-responsive to the various diuretic solutions. The state of anuria which was established by the time these animals had become completely anesthetized persisted throughout the experiment, and was uninfluenced by those diuretic solutions which in the normal control animals were of distinct diuretic value.

These observations permit rather clearly of the following deductions:

The use of an anesthetic in such naturally nephropathic animals leads to a progressive reduction in the reserve alkali of an animal's blood, and associated with this change in the acid base equilibrium there occurs a rapid reduction in the formation of urine, or the establishment of a state of anuria which is uninfluenced by various diuretic solutions.

PREVENTION OF THE TOXIC ACTION.

With these observations in mind, an attempt has been made by the use of an alkaline solution given intravenously, to protect the kidney of such naturally nephropathic animals against the toxic effect of an anesthetic.

In this series of experiments, 12 naturally nephropathic animals have been used, and a similar number of naturally nephropathic animals were employed for controls. The control animals were given, an hour prior to the anesthetic, 25 cc. per kilogram of a .09 per cent solution of sodium chlorid, while the naturally nephropathic animals, which were not to serve as controls, were given a similar amount of sodium carbonate solution equimollecular with a 0.9 per cent solution of sodium chlorid. The animals were then anesthetized by either morphin ether or Grehant's anesthetic and observations made at half-hour intervals for the duration of the experiment, which lasted an hour and half similar to the observations previously detailed.

The naturally nephropathic animals which served

as controls, and which received intravenously the sodium chlorid solution, became anuric by the time a state of satisfactory surgical anesthesia had been produced. The reserve alkali of the blood showed a reduction which varied between 7.9 to 7.8, and during the course of the anesthesia a progressive reduction in the alkali reserve occurred, so that at the termination of the experiment, the alkali reserve varied between 7.7 to 7.6. All of these animals remained anuric during the course of the experiment, and they were furthermore not responsive to diuretic solutions of theobromine, urea, glucose, and pituitrin.

The naturally nephropathic animals which received the sodium carbonate protection were all diuretic at the completion of the anesthesia. The reserve alkali varied between 8.25 to 8.15. During the course of the anesthesia these protected animals also showed the effect of the anesthetic in reducing their alkali reserve, so that at the termination of the experiment, the alkali reserve in these protected animals varied between 8 to 7.85. Those animals of the group which showed the least reduction in their alkali reserve—a reduction not under 7.9, remained diuretic during the course of the experiment, and were furthermore responsive to these diuretic solutions which were of no value in the control animals. However, those animals that received the sodium carbonate and which during the anesthetic showed a reduction in their alkali reserve to a point as low as 7.85, became anuric and were non-responsive to the diuretic solutions.

These observations permit a continuation of the observations made with the first group of nephropathic animals:

1. That the use of an anesthetic effects a reduction in the alkali reserve of the blood, which is very marked in naturally nephopathic animals.

2. That such a reduction is associated with a decrease in kidney function.

3. That if the alkali reserve of the blood during an anesthetic can be kept above 7.9, the animals not only remain diuretic but they remain responsive to the various diuretic solutions.

The histological study of the kidneys of these animals which have either remained diuretic during the experiments or have become anuric, show that in the former group there is but little evidence of degeneration of the tubular epithelium, and but a small amount of fat in the apithelium. The animals, however, which have shown a marked reduction in alkali reserve, and have become anuric and non-responsive to diuretics, show a severe swelling and necrosis of the tubular epithelium, especially that of the convoluted tubules, and the occurrence of large amounts of fat in the tubular epithelium, especially that of the ascending limb of Henle's loop.

This experimental study apparently points very clearly to the danger of an anesthetic in a naturally nephropathic animal. It furthermore shows that this danger is definitely associated with the ability of the anesthetic in a given animal to induce a disturbance in the acid-base equilibrium of the animal's blood in favor of its hydrogen ion content, and it furthermore points out that it is possible, by the judicious use of an alkaline solution, to maintain in some degree a normal acid-base equilibrium against the anesthetic, and that if this can be accomplished, the degenerative changes in the kidney, affecting especially the epithelium of the convoluted tubules, may be prevented, and the functional capacity of the kidney in some measure retained.

SAFETY FACTORS IN THE TEAM-WORK OF OPERATOR AND ANESTHETIST.*

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"There is nothing new under the sun" is an old and very true adage. While there are new things arising frequently, there are often new applications for old things. I beg leave to ask your indulgence if the thoughts expressed in this paper are not entirely new. The purpose is chiefly to emphasize and lay special stress on ideas and facts already known, but not sufficiently heeded by all who should heed them. A mere perusal of the title of this paper suggests the presence of danger. How fortunate that we should live in an age that makes use of the slogan "Safety First." The railroads have their "Stop, Look and Listen" signs, which we have all encountered while touring. We have received the admonition or noticed the sign of "Watch your Step;" the streets of the cities have their traffic officers or signs "Keep to the Right;" machine shops have been compelled by law to safeguard all machinery. In short in civil life it has become not alone a necessity but a habit to safeguard life where there is any possible danger. Have we, as members of the medical profession, taken all the precautions we could or should have taken? To this we can answer "Yes" and "No."

Inasmuch as this paper deals only with operator and anesthetist, the remarks will apply only to

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those members. Surgery, properly considered, is a therapeutic procedure. There is always an element of danger in connection with it, even though a general anesthetic is not administered. The dangers attending surgery and anesthesia, have in great part, been recognized and much has been done to overcome and prevent them and investigations keep up to prevent and minimize those which have not yet been conquered. We are all proud to note the safety signs that have thus far been erected to guide surgeons and anesthetists, in order that the surgical patient may have a safe journey for the relief and eventual cure of his ailment.

NEED OF EDUCATION.

To those who have given thought to the matter of safety, there always arises the short-sightedness of our medical colleges in not properly training the medical student in these branches. We appreciate that an anesthetic is administered to allay pain and overcome muscular contractions. The fundamental teaching for this art, as Flagg calls it, must come from the medical school. Dr. Isabel Herb, in her paper, "The Anesthetist on the Hospital Staff," says: "The slogan to be adopted, the safety device to prevent anesthetic deaths, is education." Dr. W. D. Gatch, in his paper "Anesthesia in Curriculum and Clinic" very forcibly paints the defects in teaching. He suggests a co-relation of the subjects so that there is a very forceful application of the subject of anesthesia in conjunction with physiology, pharmacology, internal medicine and operative surgery. As Gatch further says, "Where would the advances in surgery be if it were not for the advances in anesthesia?"

The surgeon requires education just as much as the anesthetist. The real surgeon seeks intensive training under an able leader before he branches out for himself. It is not altogether how good an operation can be performed, as it is, how much good will come from the operation if performed. The proper training of each and the working together of both will result in good team work.

VALUE OF TEAM WORK.

One can state with perfect safety that team work in surgery has its advantages. It is no longer an experiment but rather a well-established fact. Encouragement is given the anesthetist, who being recognized as a full-fledged specialist, assumes his place in the surgical team, not alone as the one who administers the anesthetic, but as a consultant. He helps weigh in the balance, the advisability of operating, the selection of the time that will be safest to operate, and makes the choice of the anesthetic. He helps prepare the patient for operation. To do this the anesthetist must be a trained physician.

A further object of this trained surgical team is, not alone to prevent death but to overcome or at any rate, minimize the discomforts attending surgical operations. This training having brought about specialization, in turn encourages further study and the discovery of new and hidden paths that would otherwise be unknown.

We cannot, to-day, overlook the fact that, meetings of this kind, where two or more special branches of medicine meet in joint session must bring benefit to all concerned. It should be encouraged, because in open sessions of this kind the short-comings of all can be brought out and remedies suggested. This will exemplify that old saying, "Always speak well of yourself, the other fellow will take care of your faults."

DUTY OF THE ANESTHETIST.

As was stated before, the duty of the anesthetist is not merely to administer the anesthetic agent, but to help prepare the patient for the operation. When should he begin and what preparation is needed? When it is possible the anesthetist should begin his work when the surgeon has decided that an operation is needed. It is advisable to have the patient in the hospital at least 48 hours before the operation. For some cases it may take several days to a number of weeks to properly prepare the patient. A full physical examination of the patient is advisable. With this there should be a quantitative and qualitative examination of the urine. We are no longer satisfied with a simple chemical eximination of the urine. A full knowledge of the quantity of the urine for 24 hours, specific gravity, presence or absence of albumen, sugar, acetone, diacetic acid and casts. When possible a functional test should be made. The examination for acetone before operation is too often neglected. It should be made a routine practice.

A full blood examination including the clotting time of the blood is another safeguard. While it is perhaps the rare thing to find a delayed clotting time, we may save ourselves considerable anxiety if this test is made before the operation. The work of McKesson, Miller and others on "Blood Pressure," show the great importance of this valuable, but neglected examination. The work of Polak on "Blood Pressure" and "Phthalein Output" shows very conclusively a safety first sign if properly heeded. All these examinations are given, not for the purpose of placing a mountainous obstacle to surgery, but merely to indicate some of the safety signs that will spell success to the surgeon and

gain the best end results for the patient. At this point, let me speak a word in favor of the great work done by the clinical laboratory. All too little use is made of this branch in our preoperative preparation of the patient. One of the most trying and obstinate obstacles we at times encounter is acidosis. The laboratory can be of great help to us in this condition and proper diet and medication will overcome or mitigate this condition to such an extent that surgery can be undertaken with perfect safety, and with greater comfort than would otherwise be possible. The laboratory work in diabetic cases is of inestimable value.

We often meet the argument against this preliminary stay in the hospital, that due to the great nervousness of the patient, it would react unfavorably. This is true, if no explanation is given the patient, why this extra time is needed. A great trouble is that the thinking is too often done for the patient and not by the patient. Outside of the great good to the patient by these examinations, there is another derived benefit, *viz.*, becoming hospitally acclimated and becoming acquainted with the nurse who is to have charge of the case.

It is especially in genito urinary surgery where this preoperative care and preparation of patient shows up so vividly. With this preoperative care. patients that formerly were doomed to die without operation, are now made fit subjects for surgery that affords not only relief, but oft times, cure. At any rate, comforts are given where only misery was possible before.

Another great advance in preoperative preparation is the care given the gastro intestinal tract. No longer is the surgical patient starved and purged. How true the comparison of surgical patient with the athlete in preparation for a race. We can only say that common sense, rather than the continuation of old time ideas without reason, prevails. The better physical condition the patient is in at time of operation, the happier, and shorter the convalescence.

By giving the patient the regular diet the day before the operation, supplemented as suggested by Glagg, with ½ pound of chocolates, it helps to neutralize the acidosis caused by the anesthetic.

Preoperative Medication.

Purging, or active catharsis, is not only useless, but one of the great causes of postoperative gas pains and distension. The patient should have ample sleep and rest before the operation. If necessary some sedative as bromide, chloretone or veronal should be given the night before to produce a good sleep.

Shall we use preoperative medication? While there is a great deal of negative evidence, I believe there is far more positive evidence that it should be used. It has been my rule for a long time to use the preliminary medication in the majority of cases. When I use it I give morphin 1/6 gr., or pantopon 1/3 gr., with atropin 1/150 gr., in ether cases and hysocin 1/150 gr., in gas-oxygen cases. While very occasionally I have seen a slowing of the respiration due to the morphin, I have never regretted its use in a single case. The value of morphin or pantopon, both before and after operation, is too little appreciated. There may be a marked disadvantage with inexperienced anesthetists when this preoperative medication is used, but with the experienced anesthetist, who relies on no one sign or symptom to indicate the condition of the patient, there can be no disadvantage. If there is an idiosyncrasy or a known contra-indication no preliminary narcotic medication is used. The length of the operation and the type of operation also influence its use. My choice of late, has been to use the medication sub-lingually, rather than hypermatically. The action is fully as good and the psychic effect on the patient is also very marked.

Choice of the Anesthetic.

The next thought after proper preparation of the patient and designation for time of operation will be the choice of the anesthetic. It is really surprising to read and hear the differences of opinion as to the best anesthetic agent. Statistics are of no avail in helping us to decide. It almost seems that certain sections have fads and fancies in the choice of anesthetics. It is a known fact that all anesthetic agents are poisons. It is also a fact that only experienced physicians should administer these agents. With the inexperienced we know that ether is the safest anesthetic. With the experienced, nitrous oxid and oxygen is the safest. It is also the pleasantest and has the least after effects. Those who use gas-oxygen to any extent agree that there are practically no contra-indications to its use. A short time ago, I read a paper in which the chief contra-indication to gas-oxygen was noted to be the surgeon. That still holds true where the surgeon is not accustomed to work with gas-oxygen anesthesia. The surgeon who has been in the habit of working with a deep ether anesthesia must be taught to work with gas-oxygen to have it work successfully. It is really a re-education of the surgeon. Once accustomed to its use he will work with as much ease and comfort as he did before with ether. The appealing factor in this change

is the patient. One always hears how pleasant it is to go under, how pleasant the awakening. The surgeon is surprised at the good condition of the patient, even after a long operation. It is conceded that there is not the relaxation with gas-oxygen that there is with ether. In a certain class of cases a small amount of ether may be necessary to produce the desired amount of relaxation. The success comes in the team work of operator and anesthetist. It must be a give and take proposition. The greatest fault with gas-oxygen will be found in abdominal surgery. In great part this will be overcome if the operator will make a sufficiently large incision to begin with, so that he can make all necessary examinations without being compelled to use great force in inserting his hand into the abdomen. The position of the patient on the table to insure the greatest amount of relaxation to the involved parts is another great aid. Guthrie and others have commented most favorably on the use of the slight Trendelenburg position when starting the anesthetic. This has its advantages in a number of cases. On the other hand there is great danger in extreme Trendelenburg, especially if long continued. Good judgment must prevail in knowing the patient and how much Trendelenburg position will be tolerated and for how long. Proper relaxation of the effected parts may be obtained by pillows, sandbags or with the newer type of operating table by adjustment. This relaxation helps, not alone during the operation but also on closure of incision.

The one great field that is surely but slowly adopting gas-oxygen is obstetrics. Chloroform has done noble work in obstetrics. It will never be totally replaced by gas-oxygen or any other anesthetic. It is a very valuable anesthetic agent when properly used and in properly selected cases. Ether will, of necessity, be the agent most largely used. It has its indications and in many cases its advantages over any other anesthetic. No doubt the difference in cost has been a drawback to the greater use of nitrous oxid. Greater experience has thus been gained with ether and when properly administered it compares quite favorably with gas-oxygen.

Sonnoform, which is a combination of ethyl chlorid, methyl chlorid and ethyl bromid, is largely used by dentists. It is of great value in short anesthesias where it will give greater relaxation than gas-oxygen. It is also largely used to induce ether anesthesia in place of gas. It has a further advantage in not requiring any large apparatus for its administration.

Ethyl chlorid has its advocates who are as enthusiastic as others are for ether or gas. Its chief use is for short operations or as a preliminary to ether especially with children.

The success of the administration of any anesthetic agent lies absolutely with the administrator rather than with the agent or apparatus used.

HANDLING EMERGENCIES.

The use of oxygen with any anesthetic is of great value. It increases the safety without diminishing the anesthetic value. It is a stabilizer of blood pressure, diminishes or overcomes nausea and vomiting and facilitates an earlier return to consciousness. In obstetrics, I have found it of great value in resusciation of the new-born babe.

Emergencies are always to be considered and are best met when there is team work. It may be necessary in some cases to transfuse before operation. The experienced anesthetist watches the patient so closely at all times that he can give ample warning to the operator to speed-up or even cease his work, if the patient's condition becomes unfavorable. If blood pressure observations are taken during an operation one will find evidence of danger long before it comes on and will be able to meet it, almost before it arrives. The anesthetist should know what emergency measures should be applied if occasion demands. The operator should at all times, use such speed as is commensurate with safety and good technic. All bleeding should be controlled at once. Unnecessary bruising of tissue should be avoided.

Surgical shock is a nightmare, that as yet has not been fully solved. The theory of Cannon, that it is due to absorbed toxines, arising from the bruised tissues, may explain why cases of long duration with rough handling suffer shock. We know that hemorrhage is one of the causes of shock, and nerve irritation another cause, but there are cases that as yet have received no satisfactory explanation for the appearance of shock. While no doubt further investigation will eventually solve this problem it behooves us in the meantime to consider all the supposed causes of shock and try to avoid them.

POSTOPERATIVE CARE.

What care will we now give the patient following the completion of the operation? After the dressings are applied, the patient, properly protected, is taken back to bed. The bed should be warm, hot water bottles should be placed about the patient to keep up heat, the room should be bright enough to recognize change of color in patient. The position of the patient in bed should be such as to

afford the greatest comfort to the patient, ample pillows being supplied to produce this condition Enough anodyne should be ordered to give relief from pain for the first 48 hours. Water should be given as soon as the consciousness is fully established. Rectal injections of alkaline solutions with or without glucose should be ordered if the case demand the same. Feeding should be started at a very early period. Careful watching of the patient is necessary to detect change of color or pulse rate. Absolute quiet should be enforced for the first few days.

If the anesthetic has been properly administered a very early return to consciousness is assured. This means that there is a minimum amount of anesthetic for the patient to eliminate, there will be less time required in watching till full return of consciousness, and the discomforts attending return of consciousness will be practically nil.

In conclusion I wish to emphasize, first: a change in college curriculum to meet suggested requirements. Second: a greater preoperative care and examination of patient. Third: greater team work in our hospitals.

In limiting my remarks to operator and anesthetist, it was not with the idea of minimizing the value of other members who are a part of the surgical team. There must be a concerted action of all in order to have success.

1208 SOUTH SALINA ST.

SURGICAL BARRAGE.*

CHARLES W. MOOTS, M.D.,
and
ELMER I. MCKESSON, M.D.,
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The greatest protective development in modern warfare was the so-called *Barrage*. To be effective, every minute detail was worked out with the greatest precision. Started a few seconds too early or too late meant not only a possible failure, but even worse, destruction of one part of an army by another part of the same army. Team work was absolutely essential.

A *Surgical Barrage* may be defined as the process of surrounding the surgical patient with all the skill and refinement known to specialists in the various departments of medicine and surgery during the *Preoperative, Operative, and Postoperative Periods.* Surrounded with such a barrage, the patient may reasonably anticipate the lowest possible mortality rate, with the shortest and least uncomfortable morbidity period, the latter factor becoming more and more the aim of every thoughtful surgeon.

It is our hope to briefly, yet concisely bring before you certain of the elements making up this barrage, basing our conclusions not upon theory but experience.

VALUE OF STANDARDIZATION.

First of all, we have already noticed a marked advance in the safety line to the patient by the work started by the American College of Surgeons, in the Standardization of Hospitals. This not only mean a general awakening of hospital managements, thereby increasing the efficiency of the hospital, but is destined to have an enormous influence in standardizing surgery itself. Hospital managements when selecting a staff are beginning to give occasional thoughts to some other qualifications aside from a reckoning of the number of pay patients the proposed member has been rushing to the hospital. It is to be regretted that, in the past, the latter motive has all too frequently actuated the selection of staff members by many institutions, especially those of a sectarian type.

We regret, however, that the officers of the College have apparently overlooked one important factor in their otherwise valuable standardization work, and in a few instances have even given their individual influence to the lowering of standards. We refer to professional anesthesia which matter we will discuss further along in the paper.

PSYCHIC INFLUENCE.

In the field of Gynecology much is gained for the patient as well as for the profession, by a close alliance of surgeon and psychiatrist. The patient has been taught so many foolish and untrue things about herself; and the relations of her sex organs to the entire endocrine system as well as to the nervous system, are so complex that frequent consultations with a properly trained neurologist will often avoid useless and even harmful surgery.

The Gynecologist probably comes into contact with a higher percentage of chronically ill patients than does any other surgeon. He must therefore consider with unusual care the Preoperative and Postoperative Periods. Everything possible must be done not only to raise the patient's physical condition, but her psychology must receive special attention. She should reach the hospital and be received without an unpleasant experience whenever possible. Immediate preoperative purgation is to be avoided. Fluids, especially alkalines, are given

*Read during the Fifth Annual Meeting of the Interstate Association of Anesthetists, before a Joint Session with the American Association of Obstetricians and Gynecologists, at Cincinnati, September 15-17, 1919.

freely. A good night's rest is assured by the use of sedatives and if absolutely necessary, some narcotic.

We assume that a positive diagnosis has been made if such is a human possibility, and the work well planned before the hour of operating. This bespeaks smooth, rapid surgery, without bungling haste. All known means should be used to measure the patient's resistance, including carefully acquired knowledge of the kidney function and cardio-vascular system, as well as metabolism in general. We still continue to attribute much importance to the *Pulse Pressure Ratio,* a term used to indicate the relation between the pulse pressure and the diastolic pressure, and which we discussed at length in a former paper read before this society.

VALUE OF THE PULSE PRESSURE RATIO.

We have made systematic use of the principle ever since that time, just as we did for some years previous to the report. All cases are recorded and the records comprise most interesting data for study. Dr. Miller of Providence, R. I., has recently reported, following our plan in 1,000 consecutive cases, and stated that he has found it correct and of much value. In the same article, Dr. Miller puts forth an idea that we have adopted and found to have much to commend it. He divides his cases into three classes as follows:

The good risks: Patients free from organic disease, whose surgical condition is not especially serious.

The fair risks: Patients suffering from organic disease, but whose surgical condition is not especially serious.

The poor risks: Patients whose surgical condition is so serious or so far advanced as likely to result in a fatality.

All patients of the first class are expected to recover. If a fatality should occur from among this class the case should be carefully gone over to determine whether the preoperative prognosis was in error or if the work of the surgical team is blamable for the fatality.

As an example for the second class, an operation for appendicitis might be urgently required in the case of a patient whom the examination showed to be affected with diabetes. If coma and death follow such operation, the fatality will be considered beyond human control. If no examination and no prognosis had been made, the necessity for a lame explanation of the result would have arisen.

THE QUESTION OF ANESTHESIA.

With this classification, we are now ready to consider the question of anesthesia. Shall it be Local or General, and if the latter what agent is to to be used? Any surgeon who insists that there is but one form of anesthesia or only one anesthetic, is too partisan to be a real student. If one classifies his patients as above, and seriously considers the sort of an operation he is going to do, he will soon find need of several forms of anesthesia and several anesthetic agents.

It is not our purpose to discuss at this time the question of *Local anesthesia,* but before passing it, we wish it to be understood that in our judgment it may be used in the future much more than it has been in the past, owing to great improvement in the technic of its administration. (Personally if I were without the services of a professional anesthetist who was especially skilled in the use of nitrous oxid oxygen, I would do a larger percentage of my work under Local.—Moots.)

Ether has practically solved the question of immediate mortality rate, when properly administered, and is certainly the safest general anesthetic agent in unskilled hands. It also makes toward easy surgery. There are a few factors about it, however, that do not please the surgeon who is looking for ideal anesthesia. The odor while taking as well as following the operation certainly does not leave pleasant memories on the mind of the patient; the awful nausea; the interference with the function of cells and organs as proven by the laboratory; delayed deaths, not conscientiously attributable to the surgical traumatism alone are things we like to avoid.

In 1907 we became interested in nitrous oxid-oxygen. At first our difficulties were many; ignorance of the necessity of joint study and cooperation between surgeon and professional anesthetist, poorly devised equipment for administrtion, lack of experience in the signs of anesthesia produced by this agent, lack of ability on my own part to operate with minimum traumatism, being the principle causes in the light of our present knowledge. With these propositions mastered, we are today happy in the conscious enjoyment of a technic which leaves little to be desired. *However, the kind of anesthesia and the agent used to procure it is secondary in importance to that of the anesthetist. In fact, a professional anesthetist we believe to be the most important factor in the Surgical Barrage.*

We have considered all the arguments ever offered in favor of the non-professional anesthetist, and in times past were inclined to admit that in some of them there existed a partial truth, but with our profession home from the war and such a goodly percentage ready to devote their lives to the study

and practice of anesthesia, there now exists no reason for any surgeon who is unselfishly devoted to raising the standard of hospitals and surgery, to encourage in any way non-professional anesthesia. All pro-arguments when well disected fade away, and a new light upon the screen shows the real cause of the blustering arguments, viz: The surgeon in the big clinics was not happy in the thought of a fair fee going individually to a professional anesthetist and the surgeon in the smaller cities hoped to encourage the family physician to send more cases by having him give the anesthetic. And it is quite probable that the surgeon has sometimes used the matter of the anesthesia as an excuse to give the practitioner a fee somewhat larger than the skilled anesthetist would have charged the patient.

The question of the advisability of nurses administering anesthetics has recently been brought up before us. It is our conclusion after what we feel to be an impartial study of the subject that while some nurses may be taught to administer the safer agents in uncomplicated cases in a manner highly satisfactory to the operator, yet the principle is fundamentally wrong for reasons so numerous that we hesitate to embody them in this paper. We still maintain that the administration of a general anesthetic is the giving of the most powerful and dangerous drug at the most perilous time of the patient's life. During any major operation the anesthetist may be called upon to make one or several new diagnoses and prognoses, and this certainly constitutes the practice of medicine and even demands unusual skill.

Few surgeons know much about the subject of anesthesia because the subject has not been properly taught in our colleges and hospitals. Our hopes for this subject, therefore, lie in the encouragement we give the specialty of professional anesthetists. To them we must look for advances in their line. They must be considered in our discussions during the Preoperative as well as the Operative Period. We commend the report of the Committee of Anesthesia of the American Medical Association to the effect that: "Every Hospital, certainly every large hospital, should have as a regular member of its staff an attending anesthetist whose authority in his special branch should be as complete as that of the attending surgeons in theirs."

What is meant by a qualified, professional anesthetist?

For answer, we quote from Dr. Isabella C. Herb: "The qualified anesthetist is one who is capable of making a physical examination of the patient, can interpret laboratory findings, is familiar with operative requirements, able to weigh the evidence and select the most suitable anesthetic and the method of its administration for the particular case under consideration. These qualifications require not only a thorough medical education but special training in the theory and practice of anesthesia as complete as is required in the field of surgery or its correlated specialities."

It was with extreme regret upon our part, that upon our return from the war-ridden countries, we found the legislature of our own great state, Ohio, legalizing non-professional anesthesia. Already we hear the jeers of the non-medical cults concerning the all too apparent insincerity of some of our leaders regarding their desire to really raise the standard of the medical profession.

THE TIME FACTOR.

Another factor of much importance to the patient is that of the length of time required for her operation. While not advocating bungling haste, it is certainly safe to conclude that the briefest possible time only should be utilized for any surgical procedure. All other factors being equal, her morbidity period should be in ratio to the operating period.

There is a certain length of time, varying in every case, that may be termed the "Safety Period" for operation in that particular case. The operator who absolutely knows anatomy and can easily operate speedily will therefore save many border line cases that would be lost by a slow operator who would require time far beyond that "Safety Period."

SUTURES.

We have had no experience either during our Navy service nor in private work that have caused us to change our attitude upon the question of sutures. They should be absorbable, of the smallest possible size necessary to carry out their function, and so prepared as to be absorbed as soon as their function is ended.

SHOCK.

The subject of shock is an important one and should be considered in every abdominal section. Many brilliant discusions of the causes of this condition are to be found in the recent literature, and will not be reiterated here. We believe, however, that much practical good may be gained at this time, by keeping constantly in mind three factors as follows: Pathology, Surgery and Anesthesia.

Cardio-Vascular Depression being the outstanding symptom of the condition known as shock, it is reasonable to start with the proposition that what ever means enables us to determine the very beginning of this condition, is of the greatest importance.

Now when a cardio-vascular system is reacting normally, an increased pulse rate is accompanied by an increased systolic and diastolic blood pressures, and vice-versa. The pulse pressure is roughly half as great as the diastolic pressure and is the most direct evidence we have of the amplitude of the heart contraction, the best evidence of effective blood movement. In normal sleep, the pulse rate and blood pressures are lowered but their normal relationships are maintained; so are they in an ideal anesthesia.

But during surgical operations, so many factors enter to disturb the normal reaction of the circulation that we may have many combinations, with almost never a true *stimulation*, but very frequently a *depression* of the circulatory system. The changes occur so frequently with sometimes disastrous and sometimes innocent results, that it is most desirable to be able to differentiate between them and to anticipate their onset.

BLOOD PRESSURE RULES.

There is no form of anesthesia, there is no age of patient, there is no type of operation in which one expects to see an elevation of blood pressures during the operation. Our fears are from low blood pressures, rapid pulse rate, and heart fatigue.

Circulatory Depression or Decompensation is best divided for surgical operation into three degrees:

1. Safe. 10 to 15 per cent. increase on pulse rate without change in pressure. 10 to 15 per cent. decrease in blood pressures without change in pulse rate.

2. Dangerous. 15 to 25 per cent. increase in pulse rate with 15 to 25 per cent. decrease in blood pressures.

3. Fatal. Progressively increasing pulse rate above 100 with progressively falling blood pressures of 80 or less systolic and 20 or less pulse pressure, for more than 20 minutes.

The first degree is never fatal but may gradually merge into the second degree. The second degree, beginning shock, may be regarded as dangerous in the sense that it exhausts the heart and disarms it for defense against continued low blood pressures.

The third degree is always dangerous to the life of the patient. A vicious circle is established consisting of the low blood pressure, the reduced heart nourishment which in turn still further reduces the blood pressure, and so on progressively. This usually developes within 20 minutes after the third degree depression occurs and when once well established proves fatal at once or at most within three days. The time in which shock proves fatal depends upon the cardiac muscle reserve and the effectiveness of the treatment employed. Third degree depression may be present in a patient without the usual alarming signs, but after the vicious circle becomes established, evidences of shock become well marked.

VALUF OF BLOOD PRESSURE READINGS.

With the palpating finger, no matter how skilled, one cannot determine all the characteristics of the pulse or the pulse pressures with sufficient accuracy to be of much prognostic value as to the onset and degree of circulatory depression during a surgical operation.

Blood pressures and pulse determinations every few minutes during all of the more serious operations as well as in many of the so-called minor cases are a part of the duties of every anesthetist. The information regarding the patient's fitness for the operation, his reaction to certain procedures and the immediate prognosis can be gained in no other way with the same degree of accuracy

The procedure is made convenient and easy by fastening the blood pressure cuff to the right arm and snugly binding the stethescope below it with elastic webbing. Readings can then be made at will without disturbing sterile sheets and without losing the continuity of anesthesia.

PRESERVING MUSCLE TONE.

A suitable graphic chart is preferable as a record because the tendencies of the circulation are readily compared from time to time and because the prognosis based upon these tendencies and the character of operative work to follow, can be more accurately made.

Where nitrous oxid-oxygen was available in skilled hands the war has corroborated our previous observations that this form of narcosis is one of the best shock prophylactics we have.

It is not remarkable that nitrous oxid-oxygen should be safer in shock and in preventing shock than other anesthetics when one recalls the fact that muscle cannot be paralyzed with it.

The greatest responsibility of the anesthetist is to avoid relative over-dosing of the patient in an effort to please the surgeon who may be demanding a flabby musculature.

The relaxation is not confined to straited muscles of the abdomen and extremeties, but extends to the straited muscle of the heart. The effect is at once reflected by the pulse pressure and if pushed too far the diastolic pressure is also decreased showing the action upon smooth muscle as well.

The clinical study of blood pressure has convinced us that the final factor in shock is muscular exhaustion or an interference with muscular ac-

tion. One thing is most apparent, the average patient having been profoundly anesthetized for extreme relaxation, is half shocked, a second degree depression, and it often takes but little trauma to complete the picture of third degree depression.

We might go on discussing the relation of pathology, of surgery, of anesthesia to circulatory depression and nearly all we could say would be old and familiar to all. Yet it would be of no value to Mr. or Mrs. John Doe if blood pressure determinations were not made during his or her operation to check up the technic of every member of the operating team that no unnecessary damage be done. In other words let us practice some of our knowledge in preventing shock.

SUMMARY.

We believe that there is a general knowledge of the advantage of professional anesthesia and that this factor will soon be within the reach of the majority of good surgeons. If, added to this great aid, the surgeon considers well the psychology of the patient; avoids active preoperative purgation; keeps the patient warm, and has her well filled with fluids; discreetly uses morphin; understands the pathology before him; does rapid, bloodless untraumatic surgery, he surrounds the patient with an effective barrage.

The Postoperative Period is characterized by the absence of meddlesome medication; by keeping the body warm and properly supplied with fluids, especially alkaline and often adding dextrose; all wound-dressings being exceedingly light and cool; absolute quiet for infected and traumatized cases while clean adbominal and pelvic cases should be moved about and gotten-up much earlier than formerly supposed. The opportunity offered the surgeon himself to benefit the patient by his advice and suggestions during this period, should be used with much thought and intelligent discretion.

THE ANESTHETISTS IN A NUMBER OF THE LARGER CITIES, SUCH AS NEW YORK, LOUISVILLE, TOLEDO, PROVIDENCE, SEATTLE, KANSAS CITY, SAN FRANCISCO AND LOS ANGELES, HAVE ORGANIZED LOCALLY. WHEREVER THIS HAS BEEN DONE, THE SPECIALTY OF ANESTHESIA IS IN A FLOURISHING CONDITION. THERE ARE MANY OTHER LARGE CITIES IN WHICH THERE ARE ENOUGH ANESTHETISTS TO PERFECT A LOCAL ORGANIZATION OF THE SPECIALTY TO THE ADVANTAGE OF ALL CONCERNED. IT IS TO BE HOPED THAT DURING 1920 THE ORGANIZATION OF THE SPECIALTY OF ANESTHESIA WILL GO FORWARD BY LEAPS AND BOUNDS. THIS MESSAGE IS MEANT FOR YOU! IT IS UP TO YOU TO SEE THAT YOUR COMMUNITY HAS THE BEST ANESTHETIC SERVICE OBTAINABLE AND THAT THERE ARE A SUFFICIENT NUMBER OF EXPERT ANESTHETISTS TO MEET ALL DEMANDS.

SOMNOFORM (ANESTHETIC MIXTURE) A NEGLECTED ANESTHETIC FOR ORAL SURGERY.*

OEL E. LANPHEAR, D.D.S.,
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When man found that the interfering pain, which hindered even the most skillful operation from even approximating good work, could be short-circuited, human life, liberty, and the pursuit of happiness were ushered into a new era, kaleidescopic in its limitless variations. The field of human progress was immeasurably broadened with the discovery of anesthetics suitable for subduing any of the endless varieties of pains to which human flesh is heir. Nitrous oxid and oxygen was projected on the stage of Human Endeavor in the alleviative field of Medicine to play the stellar role. It was cast in the hero's part and the studious thinking minds of today pay tribute to its ability, though they seek an anesthetic which can be given with less strain to the anesthetist, one that can be handled without a complicated machine, one with easy access to the source of supply. The most distinguished minds of all ages have endeavored to aid surgery to obtain perfect operative results in the smallest amount of time with the modicum of risk and discomfort both to patient and operator.

A limited number of men have mastered the technique of the evanescent or rapidly eliminated type of anesthetics. Few thoroughly understand nitrous oxid and oxygen and somnoform in their practical application and extreme value in the various fields of operative procedure under the multitudinous taxing psychic and physical conditions or seek to become past masters in their use.

The accursed apathy of the amateur anesthetist keeps him a tyro. He captures a single idea, puts it on a single track, or monorail and endeavors to operate without a gyroscope or stabilizer. These single track monorail anesthetists endeavor to create by word or otherwise oftentimes, (with their own lack of results as an example) many prejudices against the good work of nitrous oxide and oxygen and somnoform. Our many good earnest workers along this special line should be safeguarded against these amateurs in this most fruitful field of professional endeavor. I am a very strong advocate of the meritorious, tested agents, and they should be upheld by the anesthetist.

FIELD OF NERVE BLOCKING.

Local anesthesia produced by various chemical

*Read before the Section on Oral Surgery and Dentistry of the Interstate Association of Anesthetists, during the Fifth Annual Meeting, at Cincinnati, Sepember 15-17, 1919.

compounds of varying strength and osmotic tension are injected or projected into normal, inflamed, and pathological, human tissues with equal facility to say nothing of the psychological and physical condition of the patient. Many of the misguided amateurs are injecting unknown drugs into unknown spaces with befogged ideas of the anatomical structures upon which they are operating and erroneously terming the precedure nerve blocking. The saner minds are seeking a reaction. They are endeavoring to create a predominence of sane, scientific aseptic methods with due anatomical precision.

True nerve blocking by a skilled operator is to be indorsed. The nerve blocking anesthetist who inserts the needle into the deep tissues blocking the various nerve trunks, including the extraoral and intraoral methods, must thoroughly understand what he is doing. He must possess a thorough knowledge of the anatomy of the parts he is injecting and must understand the true meaning of asepsis, as well as possessing a thorough knowledge of the physiologic and toxic action of the agent employed. Careless, infective and defective blocking should be universally discouraged.

ADVANTAGES OF SOMNOFORM.

Close beside nitrous oxid and oxygen on our stage of Human Endeavor, we find somnoform in a star role of great worth. Somnoform most nearly approximates the ideal of the efficient anesthetic, simple equipment, ease of operation, speed of recovery of patient, uniformly good operative results. Somnoform is of great value in selective cases, for ease of operating, simplicity of machine and manipulation, comfort of patient, absence of venous swelling, speed of relaxation, speed of recovery, duration of narcosis and analgesia and transportation facilities for remote territories.

Somnoform as used at the present time is composed of ethyl chlorid, 83 per cent.; metyl chlorid, 16 per cent., and ethyl bromid, 1 per cent.

Quoting freely from DeFord, Henahan, Crile and others, anesthetic mixture is invaluable in facilitating the induction and obviating the long induction period of excitement for etherization. In operating on the upper air tract ethyl chlorid in combination is especially to be recommended because no asphyxia is developed. There is no sensation of suffocation, no cyanosis, no sterterous breathing, and if administered with percentage admixtures of atmospheric air, or oxygen, jactitation or spasm of the extremities of masseters rarely presents.

Rolland found in the combination of methyl chlorid, ethyl chlorid, and ethyl bromid an anesthetic which enters the circulation with practically the rapidity of oxygen, has an almost instantaneous effect on the nervous system and tissue cells, and on the cessation of its administration is equally as rapidly eliminated without causing any untoward complications.

PRELIMINARIES.

If you please the patient comes without a full meal, She is ushered into the dressing room where a trained nurse assists in the preparation, which is physical and psychological. One point is never allow her to be left to herself on account of mental forebodings.

Henehan holds that the aim is to have the patient as comfortable as possible and completely relaxed. Attention should be paid to this, for if the patient remains tense with the muscles contracted the tendency is to become more so, requiring a much deeper and more prolonged anesthesia. At this point it is well for the anesthetist to reassure the patient that all the nurse has promised of the virtues of the anesthetic is perfectly correct and that the outlook for the success of the operation is most promising. It is necessary also to come to an understanding with the patient regarding the respiration before inducing analgesia or anesthesia. Many persons carry a small volume of oxygen to the lungs at each inhalation and believe that their noses have little use for nasal breathing. Thus, little somnoform reaches the alveoli of the lungs. Observe carefully the volume of nasal breathing the patient does with the lips closed. The nose should be free and the patient convinced that he can breathe through the nose, especially when a nasal inhaler is used. While deep breathing is neither required nor desirable, moderate respiratory excursions are necessary for the proper induction and maintenance of anesthesia.

REPEATED ANESTHESIA.

During oral operations it may become necessary to repeat the anesthetic at the same sitting because of foreign bodies getting beyond the barriers erected to keep them from the throat or various other reasons. When necessary to repeat the anesthetic at the same sitting, sufficient time should elapse for the patient to fully recover from the effects of the first administration and at this time the mouth should be cleansed and care taken to control hemorrhage; if hemorrhage cannot be controlled by packing, the patient may be kept from smallowing blood by aspirating it mechanically. Continuous anesthesia is preferable to repeated administrations.

SIGNS OF ANESTHESIA.

The signs of somnoform anesthesia are very

easily worked out by the anesthetist who gives the vapor deliberately and notes the progress until he develops an "anesthetic sense of intuition," which will enable him to adapt the technic of administration not only to the given patient, but also to all the exigencies of the operative procedure in hand. The stages are apparently parallel and are similar to ether. Often the patient breathes very irregularly until he loses consciousness, when the rhythmic breathing begins. The pupils dilate, do not react to light, and the eye lids pressed against the cornea fails to produce reaction and the eye balls become fixed.

METHOD OF ADMINISTRATION.

Absolute care must be exercised from the beginning of the anesthetic until the nasal mask has been removed that none of the valuable anesthetic—anesthetic that has not reached the lungs—is allowed to escape. Operators must have well adapted inhalers and handle the valve with precision. With the patient in readiness we turn to one side and quietly break a capsule of somnoform on the gauze of the modified DeFord Inhaler, thus there is only somnoform vapor in the bag. Then deftly apply the inhaler to the face with the valve closed and a second capsule in place ready for snapping. Let only enough vapor escape at the first and second inhalations to anesthetize the olfactory nerve ends.

Then proceed with larger amounts, catching a part of each expiration and partly opening the valve for each inhalation until the bag is nearly full. It may be inadvisable to catch all of each exhalation. By the tenth inspiration the patient's entire breathing should be into the bag and the patient nearly ready for the operation. Endeavor to so use your anesthetic that you get a gradual progression into anesthesia from the first, disregarding the quantity of somnoform consumed. If we feel that one capsule will accomplish all work, very well. If intuition tells us that we are getting too much carbon dioxid in an individual case we allow the patient to inhale from the bag and exhale into the atmosphere until the volume in the bag is lessened to any point we wish. Then we can break the reserve capsule. If conditions are right the anesthetist's assistant immediately inserts another tube. For prolonged anesthesia in oral operations we now exchange the face piece for the nasal piece and so regulate our valves that we get free breathing enough to keep the patient narcotized. We should discourage the method so many use of carrying the patient through the preliminary stages at so rapid a pace, that the anesthetist cannot note the important stages as the patient passes under. For this method often gives us a deeper narcosis than is required or necessary for the surgical operation at hand.

ANESTHETIZING CHILDREN.

Oftentimes, children present very trying cases when persuasion is of no avail. If the operating room with its many distracting influences is the last straw or for other reasons it may be advisable to start our anesthetic in the anesthetic room by holding a small cotton roll saturated with oil of orange and ethyl chlorid under the nose while we are visiting with them, then we can proceed with the anesthetic of choice. Parents may wish that we work by force if necessary. If so, we close the valve in a Starck Inhaler, break one capsule of somnoform upon the gauze with the bag half full of pure oxygen, place a second capsule in position and put the face piece over the whole face and open the valve one-half of the opening. Endeavor to catch the next exhalation and then give the contents of bag until struggling is lessened. Then adjust the valve to secure a stage of anesthesia easily recognizable and proceed deliberately.

A DeFord Inhaler is easily modified to meet the requirements of an office by having an adaptor just in front of the valve in such a position that it is very easy to interchange the nasal and mouth piece of a machine used in that office. Thus the rubber fittings are always in A1 condition.

AFTER-CARE.

As soon as the operation is over and the patient can be left to his own resources, the gauze and inhaler should be removed and discarded and the rubber bag and the various rubber attachments sterilized by dry heat and imersion in a bichlorid of mercury solution. Both sides of the bag should be thoroughly dried and powdered with soap-stone, all excess of the powder being then removed. Unless this is done the rubber bag and the air cushion will rapidly deteriorate. The metal parts of the appliance should be sterilized by boiling.

CONCLUSIONS.

In a busy office a somnoform anesthesia can be given and the operation performed successfully with less time, skill, and patience than is necessary for a successful nerve blocking with fewer after pains. Somnoform does not necessitate the anatomical knowledge demanded by local anesthesia. For minor operations, at the bed-side somnoform is less cumbersome and more easily managed especially if the surgeon is called upon to perform the double role of anesthetist and surgeon, that is, for short operations like lancing a boil, extracting a tooth, or the short dressing of a wound. The anesthetic period allowed the operator with the analgesia period following is sufficient.

HANSELMAN BLDG.

Abstracts

A Résumé of the International Current Literature of Anesthesia and Analgesia

Modified Open Ether Anesthesia. J. W. SILK. *British Medical Journal,* May 24, 1919.

Silk uses a mixture consisting of 1 dram of chloroform and 32 drams of ether. The patient should have a preliminary injection of morphin (1/6 to 1/4 grain) and atropin (1/100 to 1/60 grain). The face pad and mask is the same as for open ether, the mask being closely applied to the face and face pad from the very beginning. The liquid is used exactly as if it consisted of ether alone, the presence of the small quantity of chloroform being ignored. During induction the liquid is poured freely onto the mask just to the verge of resentment, but when consciousness and reflexes are abolished, it will suffice to reduce the supply to the dropping stage. The combination has given excellent results.

Shock Due to Mechanical Limitation of Blood Flow. J. ERLANGER and H. S. GASSER, St. Louis. *American Journal of Physiology,* Baltimore, July 1, 1919.

An examination was made by Erlanger and Gasser of the mechanical changes in the circulation occurring in shock as induced by procedures directly involving the abdominal viscera, that is to say, in the type of shock most commonly investigated. Another method of inducing shock was the so-called mechanical shock of Janeway and Jackson. These investigators studied the effect of temporary partial occlusion of the inferior vena cava. They found that properly graded temporary partial obstruction of the inferior vena cava above the liver or of the aorta beyond the origin of the left subclavian artery eventually results in the development of a condition closely resembling traumatic shock. They are convinced that the failure of the circulation after both manipulations is in part certainly due to the consequence of the sequestration of corpuscles in the capillaries and venules, and that if back pressure in the veins, such as is produced by caval obstruction, is a factor in the development of this state of affairs in the capillaries and veins, it is not an essential one. The fact that the vasomotor mechanism need not be involved (as for example in aortic obstruction) renders it unnecessary to invoke failure of a nervous venopressor mechanism to explain the fullness of the capillaries and venules. It can be explained on the basis either of the change in character of the blood stream, or respiratory and nutritional changes in the vessel walls or, and more probably, of both.

Circulatory Failure Due to Epinephrin. J. ERLANGER and H. S. GASSER, St. Louis. *American Journal of Physiology,* Baltimore, April 1, 1919.

The experiments reported by Erlanger and Gasser show that the injection of epinephrin for a period of from twenty to thirty minutes at such a rate as to maintain a high arterial pressure invariably constricts the arteries of both the somatic and the splanchnic areas. With large doses this constriction may be maximal and outlasts the injection period, it may be, for as long as two hours. This continued constriction is partly due to central action. After sufficiently large doses, the arterial pressure, barring occasional intercurrent phenomena, fall steadily and slowly until the animal dies. The jugular pressure, during or after large injections shows no constant alteration, at least not of a kind that indicates inefficiency of the heart. The heart may become irregular for a while and occasionally stop suddenly while the arterial pressure still is high. The respiration after large doses often is slowed and may suddenly or gradually fail. The portal pressure is increased, often markedly, during their injection, and may remain high subsequently; but not uncommonly it soon returns to the normal level. Evidence is presented indicating that accumulation of blood in the portal area as a result of the increased portal hepatic resistance is not in itself the cause of the failure of the circulation. The failure of the circulation is rather to be attributed to the extreme slowing of the blood flow throughout the body caused by the constricting action of the epinephrin of the arteries. It is concluded that the cause of the failure is the same as is operative after temporary partial obstruction of the vena cava or of the aorta.

Initiation of Wound Shock and Its Relation to Surgical Shock. E. M. COWELL. *Lancet,* London, July 26, 1919.

A number of points in connection with shock are emphasized by Cowell, such as the psychic aspect of the case and the loss of circulating fluid and body heat. He agrees with other observers that during operation in such cases, or where the anatomic interference contemplated is at all extensive, the surgeon should insist on gas and oxygen anesthesia either alone or combined with regional anesthesia. During the operation a falling pressure may be counteracted by giving from 500 or 1,000 c.c. of a 6 per cent. gum solution in physiologic solution of sodium chlorid. There is no evidence of any permanent benefit following the injection of any of the numerous drugs recommended from time to time.

Blood Regeneration and Bone Marrow Activity. Editorial, *Journal, American Medical Association,* August 16, 1919.

Although the length of life of the red cells of the blood is still unknown, there is no doubt that they undergo disintegration sooner or later. Sometimes their destruction is hastened by disease; sometimes the erythrocytes are lost to the body through hemorrhage. It becomes important at times, therefore, to learn to what extent reparative processes are taking place and whether red cells are being returned to the circulation. Microscopic examination of the blood during rapid regeneration of the erythrocytes reveals the presence of nucleated forms. Nucleated red cells have therefore been taken as "an inevitable feature of rapid blood degeneration." As Macleod[1] has pointed out, however, changes in the mode of red blood cell formation may be responsible for the nucleated forms.

Some time ago Warburg[2] demonstrated that whereas normal human blood consumes very little oxygen, blood such as that of birds, which contains nucleated erythrocytes, may evince a high oxygen absorption. Morawitz[3] has observed, however, that even in mammals blood obtained during the regeneration following an anemia may show an absorption of oxygen that cannot be accounted for by nucleated cells or by substances possibly dissolved in the plasma. The explanation seems now to have been furnished by Harrop[4] of the Medical Clinic at the Johns Hopkins Hospital, Baltimore. Starting with the assumption that the red cells in the blood which appear reticulated after certain methods of histologic staining are "youthful erythrocytes," Harrop has found that blood which contains abnormal numbers of them has an oxygen absorption proportional to the percentage of reticulated cells present. These two factors are interdependent; according to Harrop, both are due to the presence of abnormal numbers of youthful cells and both are probably rather accurate indicators of functional regeneration in the bone marrow and of the amount of blood regeneration. According to this latest American research, normal mature human erythrocytes have no oxygen consumption measurable by present methods. Furthermore, when it is measurably increased in the blood of individuals with anemia, the oxygen consumption has no direct relation to the severity of this symptom, and no constant relation to histologic abnormalities in the erythrocytes other than increases in the number of reticulated cells. A large proportion of all the nonnucleated red blood cells in the bone marrow are reticulated. Accordingly, the increase in the number of these forms, along with increase in the hemoglobin of the blood and a greater oxygen consumption thereby, is indicative of increased activity of the bone marrow.

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3. Morawitz, P.: Arch. f. exper. Path. u. Pharmakol. 60:298, 1909; Ergebn. d. inn. Med. u. Kinderh, 11:277, 1913.
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American Journal of Surgery

QUARTERLY SUPPLEMENT *of* ANESTHESIA *and* ANALGESIA

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F. HOEFFER McMECHAN, A.M., M.D., *Editor*

Avon Lake, Ohio, U.S.A.

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RECOGNITION GIVEN INDIANAPOLIS ANESTHETISTS AND THE SPECIALITY OF ANESTHESIA.

The recent appointment of Drs. A. E. Guedel and Charles Cabalzer as consultant anesthetists to the staff of the Indianapolis City Hospital is significant. It is the first public recognition of anesthesia as a specialty in that city. Commenting on this matter Dr. S. E. Earp, editor of the Indianapolis *Medical Journal* in the November issue, writes as follows:

"Time was, not so long ago, when every physician would clip a pair of tonsils in his office and think nothing of it. This was then a part of the general practice of medicine. But gradually the importance of proper technic in this operation, and the acquisition of greater skill in its performance by men who had given the matter special study, has forced the operation of tonsillectomy into a field of special practice. Likewise have other specialties been borne. The diagnostician of internal medicine, the tuberculosis man, the serologist, the urologist and many others are specialists because they are better trained and have acquired more skill in their particular fields than the general physician. There is so much more to be learned about every branch of medicine than there was to be learned twenty years ago, that it is impossible for any one man to gather and retain an adequate knowledge of it all. Therefore the specialist. To learn thoroughly any one branch of medicine at this date is a task to tax the best of us, and to do it well leaves but little time for work in other branches.

"Now comes anesthesia. Its advancement in late years has been rapid. Anesthetic organizations have been formed. Special attention is given to anesthesia in some of the better journals that we read. Some of our best men are working for the advancement of good anesthesia. There are men in Indianapolis who have given much time and attention to this work and as a result, our city today stands as one of the foremost centers of the United States in this branch of medicine.

Formerly, say twelve years ago, in this community the administration of the anesthetic was commonly left to anyone who happened to be near, whether a nurse, a medical student or the family doctor. No attention was paid to it from a scientific standpoint. One surgeon would demand chloroform for all cases; another would demand ether for everyone. There was no attempt to select an anesthetic agent or method, which was particularly suited to the individual patient or operation. Then, if a patient had a heart lesion or albuminuria that patient was a bad risk and was frequently denied the benefit of a surgical operation. If a patient died under an anesthetic his death was said to be due to a bad heart or to status lymphaticus and it was assumed that his time had come; that he would have died just the same under any other anesthetic circumstances. Today this is changing. It will be some time before it has completely changed. No specialty was born in a day. But it is changing.

The special anesthetist, the man who has given long time and study to the perfection of his knowledge of this work, is among us and his presence is being felt. The technician in the administration of any anesthetic agent, he who has mastered the mechanics of it, and has gone no further, cannot be called an anesthetist. The anesthetist of the future shall be a physical diagnostician and shall be able to assist the surgeon in the selection of the anesthetic to be used and the manner of its application. He shall be able to assume all responsibility for the anesthetic. It is not uncommon even now for the surgeon to leave the selection and the administration of the anesthetic entirely to the anesthetist. The surgeon wants none of the responsibility of this work, where he can crawl from under it. It is the anesthetist in the future who shall take the bad surgical risk and develop it into the safest possible one for the condition. Patients who

are to be denied operation because of their inability to take a general anesthetic will be but few in number.

One of our anesthetists states that fully one-half of his work now comes from the patient, either direct or through the surgeon. This means that when there is to be an operation in any family, a careful and selected service in everything is desired. One of our surgeons who employs special anesthesia for most of his work states that in no case yet has the patient objected, after a brief explanation, to the extra expense of skilled anesthesia. Often now, the general practitioner over the state, when he refers a patient to the surgeons for operation, specifies the anesthetist to be employed in the case.

The day is passing when *anybody* can give the anesthetic. Recent advances in this work has made it a special practice worthy of our recognition. It is for the good of all medicine and surgery that this specialty be encouraged. Let us ask ourselves, "Were we to be operated upon who would give the anesthetic?" The question is at once answered. We want the skilled anesthetist for us and ours. Let us think of our patients with the same concern that we think of ourselves. Not only is it but fair to the patient: it is to our own advantage in every way.

In adding anesthesia to the staff of the Indianapolis City Hospital, are we leading the public, or are we supplying a public demand? In either case it is a step forward for medicine and surgery in our community."

THE QUESTION OF THE ANESTHETIST IN THE SURGICAL BARRAGE.

Speaking before the Joint Session of the Interstate Anesthetists and the American Association of Obstetricians and Gynecologists at Cincinnati, O., September 15, 1919, Dr. Charles W. Moots, of Toledo, O., emphasized anew that the professional anesthetist is the most important factor in the Surgical Barrage thrown about patients coming to operation for their protection. While Dr. Moots goes into details in his paper on this subject, published in this issue of The Supplement, the editor deems Dr. Moots such an authority in the matter of professional anesthesia that he is reprinting his pertinent remarks, editorially, so that their force and influence will have reiterated effect. Dr. Moots says:

"We have considered all the arguments ever offered in favor of the non-professional anesthetist, and in times past were inclined to admit that in some of them there existed a partial truth, but with our profession home from the war and such goodly percentage ready to devote their lives to the study and the practice of anesthesia, there now exists no reason for any surgeon, who is unselfishly devoted to raising the standard of hospitals and surgery, to encourage in any way non-professional anesthesia. All pro-arguments when well disected fade away and a new light upon the screen shows the real cause of the blustering, *viz.*: The surgeon in the big clinics was not happy in the thought of a fair fee going individually to a professional anesthetist and the surgeon in the smaller cities hoped to encourage the family physician to send more cases by having him give the anesthetic. And it is quite probable that the surgeon has some times used the matter of anesthesia as an excuse to give the practitioner a fee somewhat larger than the skilled anesthetist would have charged the patient.

"The question of the advisibility of nurses administering anesthetics has recently been brought up before us. It is our conclusion after what we feel to be an impartial study of the subject that while some nurses may be taught to administer the safer agents in uncomplicated cases in a manner highly satisfactory to the operator, yet the principle is fundamentally wrong for reasons so numerous that we hesitate to embody them in this paper. We still maintain that the administration of a general anesthetic is the giving of the most powerful and dangerous drug at the most perilous time of the patient's life. During any major operation the anesthetist may be called upon to make one or several new diagnoses and prognoses, and this certainly constitutes the practice of medicine and even demands unusual skill.

"Few surgeons know much about the subject of anesthesia because the subject has not been properly taught in our colleges and hospitals. Our hopes for this subject, therefore, lie in the encouragement we give the specialty of professional anesthetics. . . . . .

"It was with extreme regret upon our part, that upon our return from the war-ridden countries, we found the Legislature of our own great state, Ohio, legalizing non-professional anesthesia. Already we hear the jeers of the non-medical cults concerning the all too apparent insincerity of some of our leaders regarding their desire to really raise the standard of the medical profession."

In this connection it is interesting to know that the Chiropractors in Ohio are using this inconsistency of the medical profession to further their own legislative aims. Why deny Chiropractors

anything when lay anesthetists are legalized to trifle with life in its most perilous moments.

It is doubly interesting to know that in the great and glorious Commonwealth of Ohio, from the statistics of Drs. Salzer and Stewart that coroners', hospital and surgeons' figures all show a mortality rate of at least one death in every five hundred anesthesias, irrespective of the agent employed. It is to be hoped that coroners will presently demand an explanation for this state of affairs. It is no wonder with this prospect in view that the Southern California Association of Anesthetists is trying to protect the people of California from exploited lay anesthesia and anesthetists now being foisted on the country by nurse anesthetist mills in New York, Cleveland and Rochester.

The Editor also hopes that those who fostered the campaign against *fee splitting* will presently get busy in dealing with those who are charging professional anesthetic rates for camouflaged services and are putting the profits in their pockets. If the profession-at-large does not deal with these profiteers drastically some one else presently will.

Considerable interest is being shown on the Pacific Coast with regard to ridding the profession of lay practioners and technicians. In this connection the following resolution adopted unanimously by the Los Angeles County Medical Association, on October 16, 1919, is significant:

"Resolved, That the Los Angeles Medical Association go on record as in favor of the limitation of the practice of anesthesia to regularly licensed physicians and surgeons."—McM.

THE NATIONAL ANESTHESIA RESEARCH SOCIETY.

After several meetings to discuss ways and means of advancing the progress of anesthesia not only for the welfare of the public, but also of surgery and the specialty, a number of the forward-looking manufacturers of anesthetic agents and apparatus have formed a business organization with a limited appropriation for 1920 to establish the National Anesthesia Research Society in the hope that their efforts may eventually be broadened into an Anesthesia Foundation.

For the present all efforts will be directed toward the stimulation of research in anesthesia and it is confidently expected that those who are doing such research work will lend the prestige of their names to the roster of the Research Committee of which the Editor of the SUPPLEMENT has accepted the Chairmanship and Dr. W. I. Jones, of Columbus, O., the Secretaryship.

A very broad program for ultimate accomplishment has been made a part of the By-Laws of the new organization and the details of this program will be announced in the next issue.

A canvass is now being made to interest research workers in becoming members of the Research Committee. This membership entails no responsibility other than the making of research results available for the scientific educational campaign of the Society.—McM.

Society Proceedings

Membership in a society devoted to your specialty is an essential to success.

INTERSTATE ASSOCIATION OF ANESTHETISTS. —FIFTH ANNUAL MEETING.

The Interstate Association of Anesthetists held its Fifth Annual Meeting in Cincinnati, Ohio, at the Hotel Gibson, September 15-16, 1919.

After the address of welcome by Dr. C. T. Souther, of Cincinnati, Dr. E. I. McKesson presented the gavel to Dr. J. J. Buetter, of Syracuse, N. Y., chairman-elect, who then presided.

During the executive session the minutes of the previous meeting and the treasurer's report were accepted as read. The following officers and members of the executive committee were elected for the 1920 meeting:

W. I. Jones, D.D.S., Columbus, O., Chairman; Samuel Johnston, M.D., Toronto, Canada, Vice-Chairman; F. H. McMechan, M.D., Avon Lake, O., Secretary-Treasurer; A. S. McCormick, M.D., Akron; John H. Evans, M.D., Buffalo; Marie Kast, M.D., Indianapolis; A. E. Smith, D.D.S., Chicago; Ralph M. Waters, M.D., Sioux City, and Roy S. Hopkinson, D.D.S., Milwaukee.

The secretary-treasurer was voted an appropriation of $250 for his services during the past year. The place of meeting, as usual, for the 1920 meeting was left to the discretion of the officers and executive committee.

The following members were elected: Drs. Myra E. Babcock, Detroit; W. D. Braun, Buffalo; A. D. Caldwell, Platesmouth, Neb.; Cline M. Chipman, Washington, D. C.; Morris H. Clark, Kansas City; Rozelle M. Cope, London, O.; S. J. Coulter, Toledo, O.; F. E. Coultrap, Toledo, O.; P. L. Crume, Dayton, O.; J. C. G. Fitzhugh, McKeesport, Pa.; James A. Flanagan, Shenandoah, Pa.; T. L. Gregg, Dayton, O.; Frances E. Haines, Chicago; Walter H. Hartung, Toledo, O.; T. F. Higgins, Toledo, O.; W. J. Hodson, Dallas, Tex.; F. B. Jones, Cleveland; G. W. Kiel, Columbus, O.; C. LaRocque, Montreal; D. A. Leahy, Cincinnati; A. J. Lewis, Dayton, O.; A. J. Marlewski, Cleveland; Anna W. Marquis, Norwich, N. Y.; R. C. Matteson, Sioux City, Ia.; John Morgan, Rochester, N. Y.; H. C. Neale, Pittsburgh; F. M. Ogden, Cincinnati; H. E. Packard, Sioux City, Ia.; E. A. Peebles, Wilmington, O.; J. G. Poe, Dallas, Tex.; C. E. Price, Toledo, O.; C. J. Reynolds, Buffalo, N. Y.; C. E. Richmond, Colorado Springs, Col.; S. D. Ruggles, Portsmouth, O.; K. I. Sanes, Pittsburgh; C. R. Singleton, Clarksburg, W. Va.; Edyth Smith, Cincinnati; F. J. Sullivan, Columbus, O.; Joseph S. Sullivan, Toledo, O.; R. W. Weaver, McKeesport, Pa., and C. W. Wilkinson, Sioux City, Ia.

During the scientific session the following papers were presented:

Reaction of the Tubercular to Ether Therapy, Ernst Zueblin, M.D., Cincinnati;

The Blood Picture in Experimental Ether Anesthesia, J. B. Rogers, M.D., Cincinnati;

Some Results from Anesthesia Experiments on Animals, W. I. Jones, D.D.S., and Clayton McPeek, M.D., Columbus, O.;

The Third Stage of Ether—A Subclassification, Arthur E. Guedel, M.D., Indianapolis;

Selective Anesthesia, Morris H. Clark, M.D., Kansas City, Mo.;

Draw-Over Ether Vapor Anesthesia; Its Advantages and Apparatus for Use, Ben Morgan, M.D., Chicago;

General Anesthetics for Intraoral Operations, C. H. Burmeister, D.D.S., Cincinnati;

Nitrous Oxide-Oxygen Anesthesia for Oral Surgery and Dentistry, J. P. Henahan, D.D.S., Cleveland;

Somnoform, a Neglected Anesthetic for Oral Surgery, Oel E. Lanphear, D.D.S., Kalamazoo, Mich.;

Possibilities and Limitations of Local Anesthesia for Oral Surgery, Bion R. East, D.D.S., Detroit;

Postoperative Lung Complications with Special Reference to Oral Procedures, Isabella C. Herb, M.D., Chicago;

The Advantages of General Over Local Anesthesia in Tonsillectomy, Harvey M. Becker, M.D., Sunbury, Pa.;

Can Anesthesia Be Made a Specialty?, Cline N. Chipman, M.D., Washington, D. C.;

What Can Be Accomplished by Local Organization?, A. W. Hartung, M.D., Toledo, O.;

The Question of Fees and Advertising, C. C. McLean, M.D., Dayton, O.;

The Legal Status of the Non-Medical Anesthetist, Mr. Lewis, Counsel N. Y. State Medical Society.

The Interstate was accorded a Joint Session by the American Association of Obstetricians and Gynecologists. During this session the following papers were presented and discussed:

Safety Factors in the Team-Work of Operator and Anesthetist, John J. Buettner, M.D., Syracuse, N. Y.;

Surgical Barrage, Chas. W. Moots, M.D., and E. I. McKesson, M.D., Toledo, O.;

Nitrous Oxide-Oxygen Anesthesia in Labor, Charles E. Turner, M.D., Columbus, O.;

Some Adjuncts Which Promote Efficiency in the Use of Local Anesthesia in Major Surgery, R. E. Farr, M.D., Minneapolis, Minn.;

Post-Operative Analgesia, Bertha Van Hoosen, M.D., Chicago.

The Annual Dinner was served by the Hotel Gibson in the Cascade Room on the first evening of the meeting. The visiting ladies were entertained at several theater parties.

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Of the Current Literature of Anesthesia and Analgesia.

ANESTHESIA, GENERAL IN AMERICA. H. Wilderman, Philadelphia. Journal de Medicine de Bordeaux, August 10, 1919.

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ANESTHESIA, TRAINING OF SPECIALISTS TO ADMINISTER. J. C. Oliver, Cincinnati. Modern Hospital, September, 1919.

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